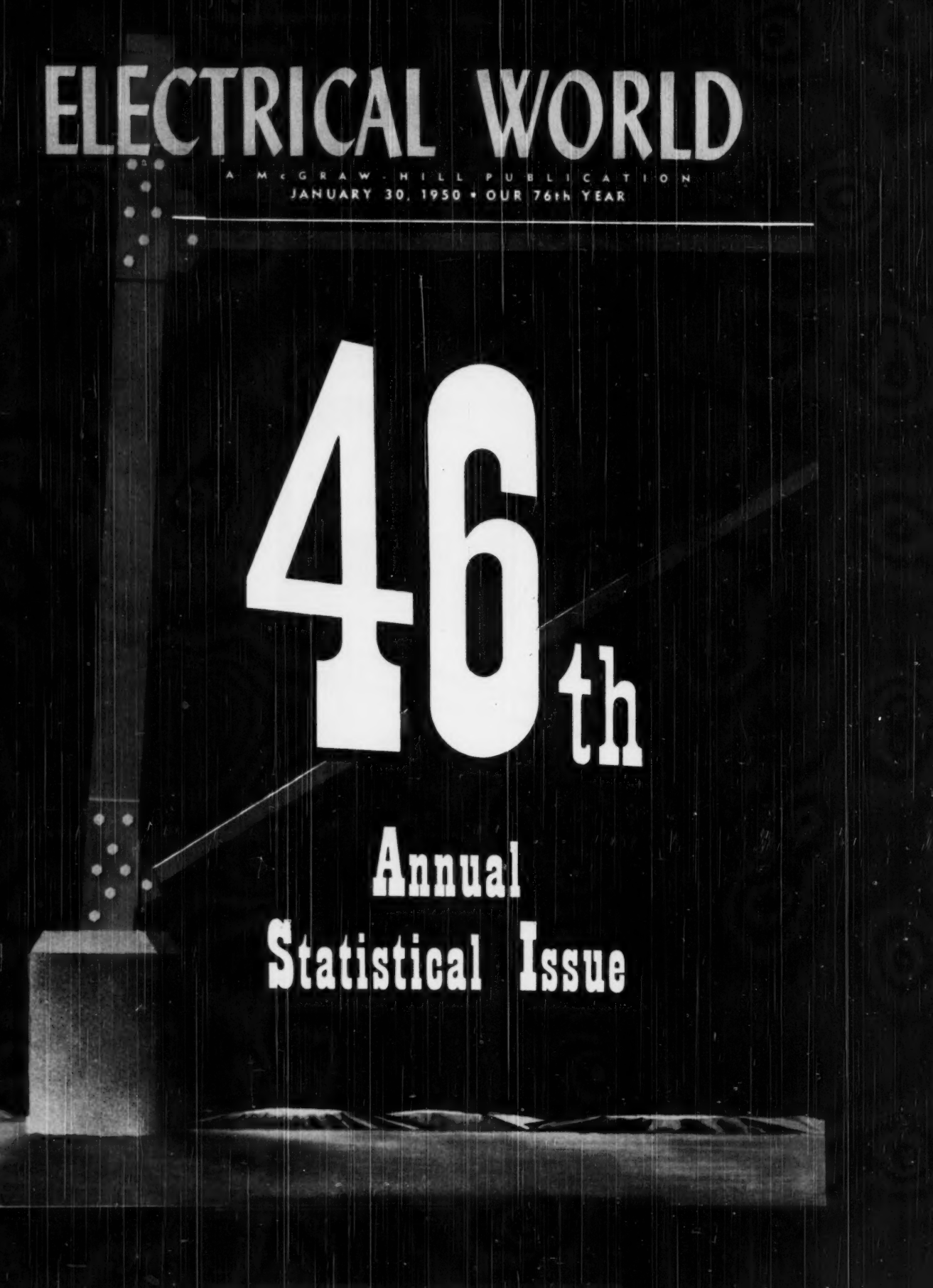
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION
JANUARY 30, 1950 • OUR 76th YEAR



46th

Annual Statistical Issue

"Built-in" OPERATING ASSURANCE

FOR BUILDERS OF ELECTRIFIED EQUIPMENT!

Nowhere does WESTON *dependability* and *value* pay bigger returns than on the panels or controls of electrical equipment. By consistently *telling the truth*, they help assure efficient performance of the equipment in users' hands . . . where *so much* depends on instrument performance. Moreover, the name WESTON on a panel instrument gains instant recognition . . . helps build buyer acceptance for the products on which they are installed. Available in types, sizes, ranges and styles for all needs. Ask your nearest WESTON representative for all the facts, or write for bulletin A-7-B. WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON
Panel Instruments

Albany • Atlanta • Boston • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Jacksonville • Knoxville
Little Rock • Los Angeles • Meridan • Minneapolis • Newark • New Orleans • New York • Orlando • Philadelphia • Phoenix • Pittsburgh • Rochester
San Francisco • Seattle • St. Louis • Syracuse • Tulsa • Washington, D. C. • In Canada, Northern Electric Company, Ltd., Powerlite Devices, Ltd.

ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

Vol. 133 — JANUARY 30, 1950 — No. 5

EDITORIALS 87

NEWS . . The Electrical Week Washington Comment Technical Notes 89

46th ANNUAL STATISTICAL ISSUE 99

Output, sales and revenue continued to rise in 1949, but much slower than in 1948 and 1947. Installation of new capacity largest ever, and in 1950 will be almost as much. Construction budget for 1950 close to $2.5 billion.

OUTSTANDING FACTS 100
A LOOK AHEAD 101
BUDGET 104
NEW CAPACITY 106
TRANSMISSION AND SUBSTATIONS 110
RURAL LINES 111
MAINTENANCE 112
CUSTOMERS 113
ENERGY SALES 114
REVENUE 116
OUTPUT 118
CAPACITY (Summary) 120
STATION ECONOMICS 122
REA 124
MANUFACTURING 126
FINANCIAL 128

HOW TO 131
Converted Fog Generator Dries Transformers
Selenium Rectifier Uses New Cooling Method
A Service Wire Support for Low Buildings
Austerity Cuts Weight of Meter Testers' Kits

ENGINEERING REFERENCE SHEETS 142
Vector Conversion Nomogram
Voltage Drop and Conduit Size For Three Single-Conductor, 600-v Cables

LOAD BUILDING 158
Degreasing Cabinets with Infrared Heat
Function and Decoration Combined
Air Conditioning Doubles Potato Storage Life

NEW EQUIPMENT 164
NEWS ABOUT PEOPLE 183
MANUFACTURERS AND MARKETS 190
NEW ELECTRICAL CONSTRUCTION 192
CATALOGS AND BULLETINS 194
TECHNICAL LITERATURE 195
BOOKS 196
LETTERS 198
INDEX OF ADVERTISERS 206

RALPH H FLYNN, *Publisher* FISCHER BLACK, *Editor* DANIEL T BRAYMER, *Managing Editor*

ARCHER E KNOWLTON *Senior Associate Editor* FRANCIS J KOVALCIK..... *Assistant Editor* EDWARD ALLEN..... *Midwestern Editor*
FRANK R INNES..... *Associate Editor* KENNETH K KOST..... *News Editor* EARL CARVER..... *Art Editor*
ROBERT C BLATT..... *Associate Editor* LOIS A STEWART..... *Assistant News Editor* BERLON C COOPER..... *Lighting Consultant*
W B WHICHARD..... *Associate Editor* JOSEPH A ROBINSON..... *Pacific Coast Editor* GEORGE B BRYANT, JR. *Mgr Washington Bureau*
RUE M SHOOP..... *Assistant Editor* HOWARD S KNOWLTON..*New England Editor* RONALD D ROSS..*Washington Correspondent*

WORLD NEWS BUREAU, Russell F Anderson, *Editor*, London, Paris, Frankfurt, Moscow, Tokyo, Bombay, Melbourne, Rio de Janeiro, Buenos Aires
DOMESTIC NEWS BUREAUS, Atlanta, Chicago, Cleveland, Detroit, San Francisco, Houston. Correspondents in 43 principal cities
ECONOMICS DEPARTMENT, Dexter M Keezer, *Director*, William F Butler, Sanford S Parker, Robert P Ulin

DISTRICT MANAGERS, E F Coffey, New York; N V Palmer, Boston; F P Coyle, Philadelphia; C R Lippold, Cleveland; P S Griffin, Detroit; W H Meneilley, Chicago; J T Schaefer, St. Louis

ELECTRICAL WORLD, Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. James H McGraw (1860-1948), Founder; James H McGraw, Jr, President; Curtis W McGraw, Vice-President and Treasurer; Eugene DuField, Senior Vice-President, Publications Division, Nelson Bond, Vice-President and Director of Advertising; J E Blackburn, Jr, Vice-President and Director of Circulation; Joseph A Gerardi, Secretary. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Copyright 1950, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents. Cable address McGRAW HILL, New York. Member ABP Member ABC

15 Year Proof-

ON HARD-TO-CONTROL EQUIPMENT!

REGULATING VOLTAGE for the Good Samaritan Hospital of Cincinnati since 1934 without maintenance or repair of any sort except for one bearing adjustment . . . that's the record of these Allis-Chalmers Rocking Contact Voltage Regulators. "Our machinery is slow speed—difficult to control—yet our regulation is good!" says Mr. W. A. Garrett, Chief Engineer.

This is the kind of *proven* dependability and low maintenance you can get with Rocking Contact Regulators. They have no vibrating contacts and no gliding friction . . . no complex adjustments to make. This simplicity means years of trouble-free service for you.

They are precision built for *Instant Response* and *Accuracy*. Contact sectors are supported in jeweled bearings . . . rock on carefully machined commutator segments heavily plated with silver for reliable, long-life accuracy.

Rocking Contact Voltage Regulators are available for both a-c and d-c generators of any size and speed, for either parallel operation or unit control. Call your nearby A-C office or write direct. A-2887

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

OTHER ALLIS-CHALMERS SPECIAL CONTROL

SYNCHRO-OPERATOR — Automatically synchronizes alternating current generators, tie lines, synchronous condensers, etc.

D.C. POSITIONER — Operates from power plant d-c bus, used for remote indication, control, order telegraph, etc.

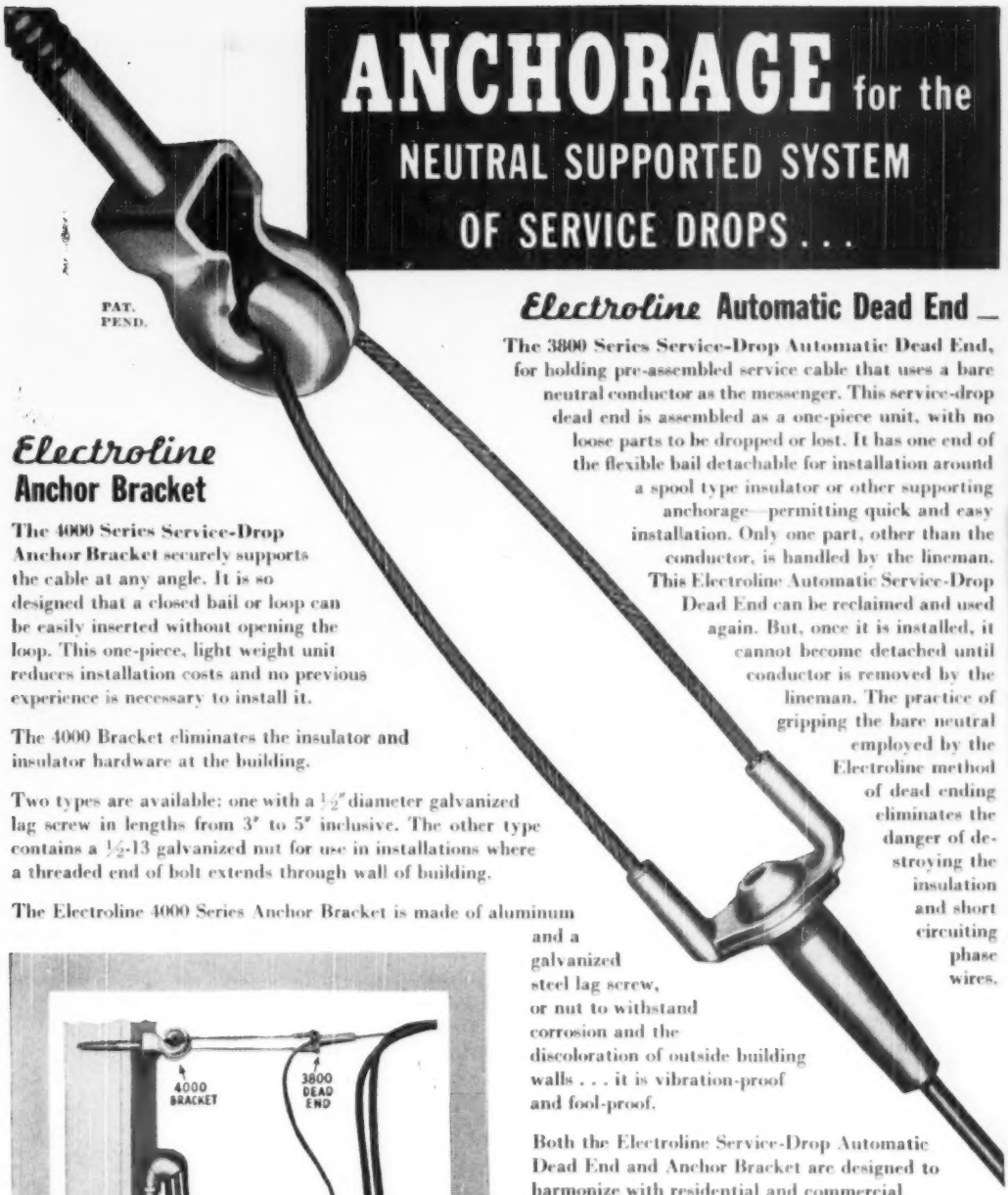
REGULEX CONTROL — Used where the features of a rotating type regulator are desired.

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

ANCHORAGE for the NEUTRAL SUPPORTED SYSTEM OF SERVICE DROPS . . .



PAT. PEND.

Electroline Automatic Dead End

The 3800 Series Service-Drop Automatic Dead End, for holding pre-assembled service cable that uses a bare neutral conductor as the messenger. This service-drop dead end is assembled as a one-piece unit, with no loose parts to be dropped or lost. It has one end of the flexible bail detachable for installation around a spool type insulator or other supporting anchorage—permitting quick and easy installation. Only one part, other than the conductor, is handled by the lineman. This Electroline Automatic Service-Drop Dead End can be reclaimed and used again. But, once it is installed, it cannot become detached until conductor is removed by the lineman. The practice of gripping the bare neutral employed by the Electroline method of dead ending eliminates the danger of destroying the insulation and short circuiting phase wires.

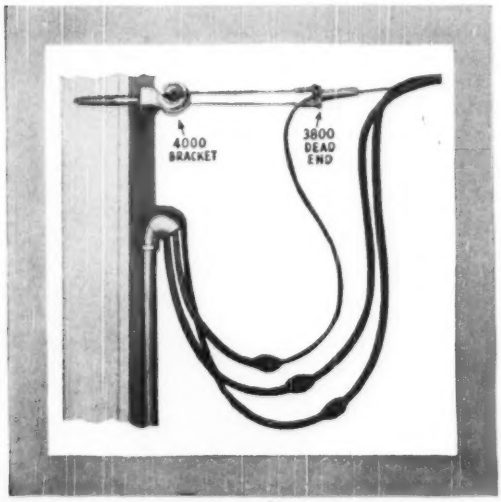
Electroline Anchor Bracket

The 4000 Series Service-Drop Anchor Bracket securely supports the cable at any angle. It is so designed that a closed bail or loop can be easily inserted without opening the loop. This one-piece, light weight unit reduces installation costs and no previous experience is necessary to install it.

The 4000 Bracket eliminates the insulator and insulator hardware at the building.

Two types are available: one with a ½" diameter galvanized lag screw in lengths from 3" to 5" inclusive. The other type contains a ½-13 galvanized nut for use in installations where a threaded end of bolt extends through wall of building.

The Electroline 4000 Series Anchor Bracket is made of aluminum and a galvanized steel lag screw, or nut to withstand corrosion and the discoloration of outside building walls . . . it is vibration-proof and fool-proof.



Both the Electroline Service-Drop Automatic Dead End and Anchor Bracket are designed to harmonize with residential and commercial buildings.

Write for new bulletins for complete details.

Electroline Company

4121 South La Salle Street Chicago 9, Illinois

IN CANADA
POWERLITE DEVICES, LTD., TORONTO

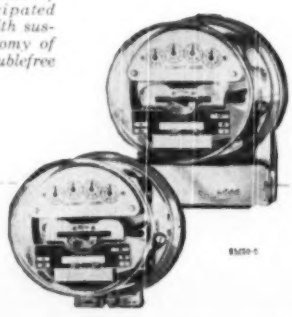
Sangamo J Watthour Meters

Sangamo J Meters have a good reputation for long troublefree service. They are designed to reduce repairs to a minimum . . . They have unusual freedom from electrical failure due to high insulation levels . . . Troublefree operation is inherent in the oilless bearing system.

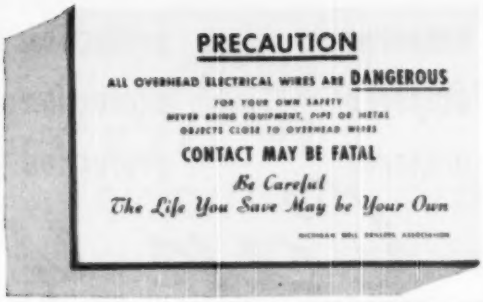
But when infrequent repairs *are* needed —all that is necessary is a small stock of interchangeable parts, and a minimum of time. Even a potential coil or a current element can be easily replaced in a matter of minutes—right in your own shop—with Sangamo's separable electromagnetic element! You can replace any part of a Sangamo J Meter and be well within the range of adjustment.

Sangamo Watthour Meters on your system mean lower labor costs, a smaller stock of parts, and fewer meters on the shelf.

Sangamo J Meters have proved their ability to meet the requirements of today and the anticipated loads of the future with sustained accuracy, economy of maintenance and troublefree performance.



SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS


PRECAUTION
ALL OVERHEAD ELECTRICAL WIRES ARE DANGEROUS
FOR YOUR OWN SAFETY
NEVER BRING EQUIPMENT, PIPE OR METAL
OBJECTS CLOSE TO OVERHEAD WIRES
CONTACT MAY BE FATAL
Be Careful
The Life You Save May be Your Own

These Graphic LAMICOID® signs, made for Consumers Power Company, Jackson, Mich., stay clear and bright despite rain and sun, heat and cold.

For clarity and permanence they "signed up" the right material...

Graphic Lamicoid

Consumers Power Company wanted warning signs that could be seen clearly. Signs that would keep their brilliant colors. Signs that would resist weathering and industrial fumes. So they specified Graphic LAMICOID.

This rigid, tough, moisture-resistant panel has printed matter permanently laminated in the thermosetting plastic sheet. The black-on-yellow printing—most visible color combination known—is protected by a surface of special age-resisting resins. Smooth and hard, it resists wear, won't check or cloud, does not readily pick up dirt, and can be wiped clean with a damp cloth.

Graphic LAMICOID needs no frames, no glass, and can be drilled, tapped, punched or sawed. These features make it unusually easy and economical to install.

For clear and durable signs, dials, wiring diagrams, plotting boards and nameplates, look into the unusual advantages of LAMICOID, in Graphic, Translucent or Engraving grades. Ask our nearest sales office for complete information.

MICA *Insulator* COMPANY

Schenectady 1, New York

Offices in Principal Cities

NOW! { 4500 amperes / 6900 amperes / 8600 amperes } POWER FUSE protection for $11.60 / 16.80 / 20.25

Can you

PRICES ARE WAY DOWN — on S&C Liquid Power Fuse equipment for 7,500- and 15,000-volt installation, making its dependable performance available for wider application.

Now there is no need to gamble on cutouts where high short-circuit currents are available. Nor is there need to pay a heavy premium over cutout prices to get reliable power fuse protection for 6,900- to 13,800-volt distribution transformer and substation installations.

Two innovations have made the advantages of the Liquid Power Fuse available at the new low prices shown below: (a) The new Simplified Mounting, pictured and described here, which is **better,** yet cheaper, than the conventional switch insulator type mounting it replaces and, (b) a new plan for the purchase of Liquid Fuses which reduces prices and does away with the need for returning blown fuses to the factory for refill.

Comparison of interrupting ratings and costs ① of the Liquid Fuse with other typical protective devices follow:

	Ordinary Open Drop-Out Cutouts		Drop-Out Power Fuses				Liquid Power Fuses With Simplified Mounting			
			Expulsion Type Using			Solid Material Type				
			Fuse Link		Fuse Unit					
Ampere Rating Range	To 100E	100E to 200E	To 100E	100E to 200E	½-125E	½-200E	1-10E (Size 1)	10-20E (Size 2)	½-50E (Size 3)	½-125E (Size 4)
					7500 VOLTS					
Interrupting Ratings in amperes, rms, asymmetrical	2000	4000	4000	6000	5000	12,000	4500	4500	6900	8600
First Cost ②	$13.75	$21.30	$44.38	$44.92	$44.50	$54.00	$11.60	$12.45	$16.80	$20.25
20-Year Equipment Cost ③	14.02	22.11	45.14	46.00	47.80	57.60	13.34	14.70	21.00	26.25
					15,000 VOLTS					
Interrupting Ratings in amperes, rms, asymmetrical	2000	4000	4000	6000	8000	11,000	3900	3900	5900	7400
First Cost ②	$16.95	$26.13	$47.46	$48.00	$47.50	$60.50	$13.95	$14.45	$18.80	$22.95
20-Year Equipment Cost ③	17.22	26.94	48.22	49.08	50.80	64.40	15.05	17.75	23.75	30.15

① Costs computed from prices in effect September 1949, using maximum discount quantities.
② Includes mounting and fuse, fuse link, refill unit, or fuse unit.
③ First cost plus 20-year cost of re-fusing.

DESIGNED FOR

FULL COVERAGE

FULL COVERAGE FUSING IS: the **new concept of transformer fusing** in which a primary fuse is applied for **both** primary short circuit and secondary back-up short circuit protection.

FULL COVERAGE FUSING PROVIDES—in addition to primary short circuit and secondary back-up short circuit protection—savings in operating expense by:

(1) **Eliminating the need for replacement of "suspect" fuses, links, or refills on other phases when one fuse blows.**

(2) **Eliminating the need for periodic replacement of fuses, links, or refills to prevent "sneak-outs" caused by vibration- or age-weakened fusible elements.**

(3) **Eliminating "sneak-outs" caused by high current surges.**

FULL COVERAGE FUSING REQUIRES: dependable high and low fault-current interrupting ability; a fine degree of accuracy in time-current characteristics; a "non-damageable" fusible element which cannot be injured by surge currents, vibration, or aging, and a full range of speeds—standard, slow, and time-lag—to provide flexibility in coordinating with other primary, and with the secondary, protective devices.

OTHER BENEFITS YOU GET WITH S&C LIQUID POWER FUSES:

1. **Short Arcing Time**—Shortest of **any** power fuse or cutout.
2. **No Interference from Sleet or Glaze**—because drop out action not needed to prevent tracking or to indicate a blown fuse.
3. **All Low Fault Currents Cleared**—unlike expulsion type devices, Liquid Fuses clear **all** types of low fault currents dependably.
4. **Stable Time-Current Characteristics**—achieved through S&C "Non-Damageable Fusible Element Construction", permit close, permanent, coordination; and eliminate "sneak-outs" (unnecessary outages).
5. **Fire Hazard Minimized**—no hot metal ejected to cause grass or underbrush fires.

S&C ELECTRIC

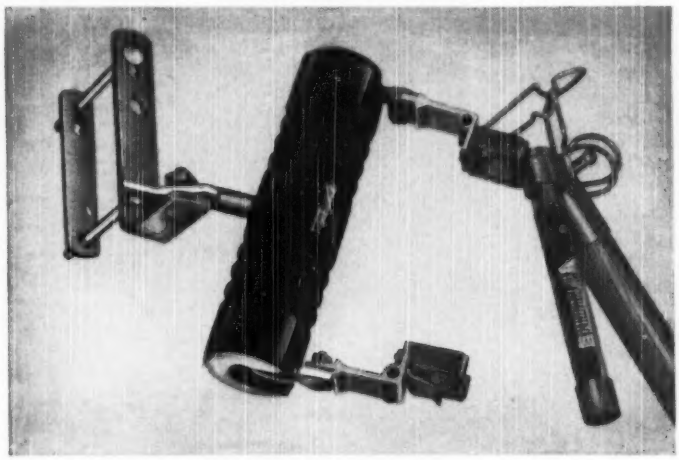
Formerly SCHWEITZER & CONRAD, INC.

longer afford to gamble on—

cutouts to protect investment and service continuity where high fault currents are possible?

NEW SIMPLIFIED MOUNTING FOR S&C LIQUID POWER FUSES

One reason for the low prices of this fuse and mounting combination is the new Simplified Mounting. As shown by the illustration, it is smaller and lighter than other type mountings. Yet streamlining has actually improved its insulation values by increasing leakage distances and flashover characteristics. In fact, its insulation values greatly exceed NEMA Standards for cutouts, and equal NEMA Standards for switch and bus insulators.



7,500-volt, 20E-ampere, Size 2 Liquid Power Fuse and Simplified Mounting. Total cost of mounting, hanger, fuse and clips—$12.45. Interrupting rating—4500 amperes.

Its first cost is lower. Its installation costs are lower.

It is bird- and animal-proof because the mounting bracket is located on the opposite side of the insulator from the live parts.

A NEMA Standard hanger and adjustable mounting bracket provide exceptional flexibility in positioning on cross arm, pole, or structure.

New fuse clips provide easy fuse handling with any ordinary hook stick.

Write today for full information given in new Catalog Section 223.

NEW NON-EXCHANGE PLAN FOR PURCHASE OF S&C LIQUID POWER FUSES

Another reason for the low prices of this new fuse and mounting combination is the reduction in costs made possible by the elimination of factory refilling of S&C Liquid Fuses. This can be done now under an alternative purchasing arrangement known as the Non-Exchange Plan.

This plan will be a money saver for most users of type B, COR, and D Liquid Fuses (of any voltage or size). Ask your S&C Representative for details, or write the factory.

COMPANY 4421 Ravenswood Avenue
Chicago 40, Illinois, U. S. A.

IN CANADA Powerlite DEVICES LIMITED, TORONTO

Because IT *MUST* BE RIGHT

You can count on

TRIANGLE

You can see for yourself that it takes massive machines to turn out lead covered and high voltage cables to meet today's rigid specifications. But machines alone cannot do the job: behind them must be men of many years' experience in making cable — in making it *right*.

At Triangle's efficient New Brunswick plant you will find modern machines manned by true craftsmen, checked by rigorous inspection, backed by unceasing development and research. To you, this means the finest in parkway...power...varnished cambric ...lead covered cables that can be constructed — today's top value in wire and cable.

Whether your needs are for standard cables built to I.P.C.E.A. recommendations, or for special cables tailor made to your own specifications, you will find Triangle engineers glad to consult with you.

TYPE RLJFJ

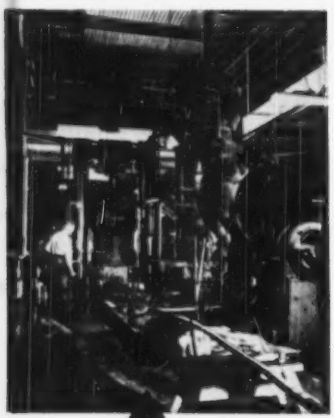
PARKWAY CABLE

TYPE VML

LEAD COVERED CABLE

TYPE V

VARNISHED CAMBRIC CABLE



Protection Plus—This huge press produces a smooth, uniform sheath of virgin lead for utmost cable protection.

The Trade Mark Of Top Value

TRIANGLE CONDUIT & CABLE CO., INC.

1900 JERSEY AVENUE • NEW BRUNSWICK, NEW JERSEY

IT *MUST* BE RIGHT!

Catalog No. 500 Gives Full Details Of the Complete Triangle Line

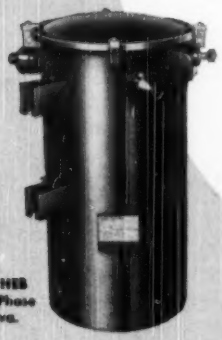
"Glazon" & "Trioseal" Building Wire • "Tricon" Control Wire • "Adaptal" General Purpose Wire • "Triex" Non-Metallic Sheathed Cable • "Triaprene" Trench Cable • Service Entrance, Parkway, Power & Varnished Cambric Cables • "Tristeel" Flexible, Thin Wall & Rigid Steel Conduit

Wagner Distribution Transformers

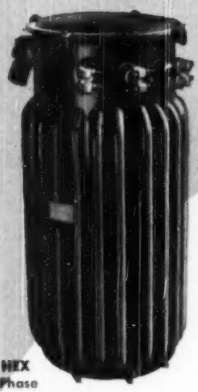
are Standardized in every rating and design

IN ACCORDANCE WITH E.E.I.—NEMA FOURTH REPORT

Type HEK
Single Phase
37½ kva.

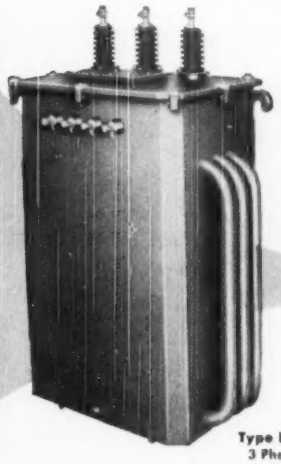


Type HEB
Single Phase
15 kva.

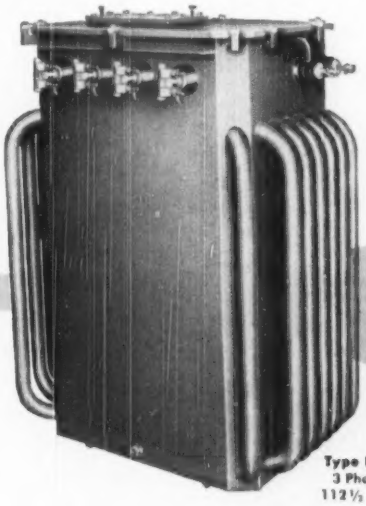


Type HEX
Single Phase
100 kva.

Wagner's complete line of distribution transformers includes every rating and design listed in the E.E.I.—NEMA Fourth Report—no matter what your particular requirements may be . . . there's a Wagner transformer to fit your needs.



Type HPK
3 Phase
45 kva.



Type HPB
3 Phase
112½ kva.

You save time, money and worry when you make your selection from Wagner's widely diversified line of distribution transformers — you get the benefit of Wagner's quality construction, improved design, and high efficiency with *standardized* mechanical features in ratings of 500 kva and below — 15,000 volts and below.

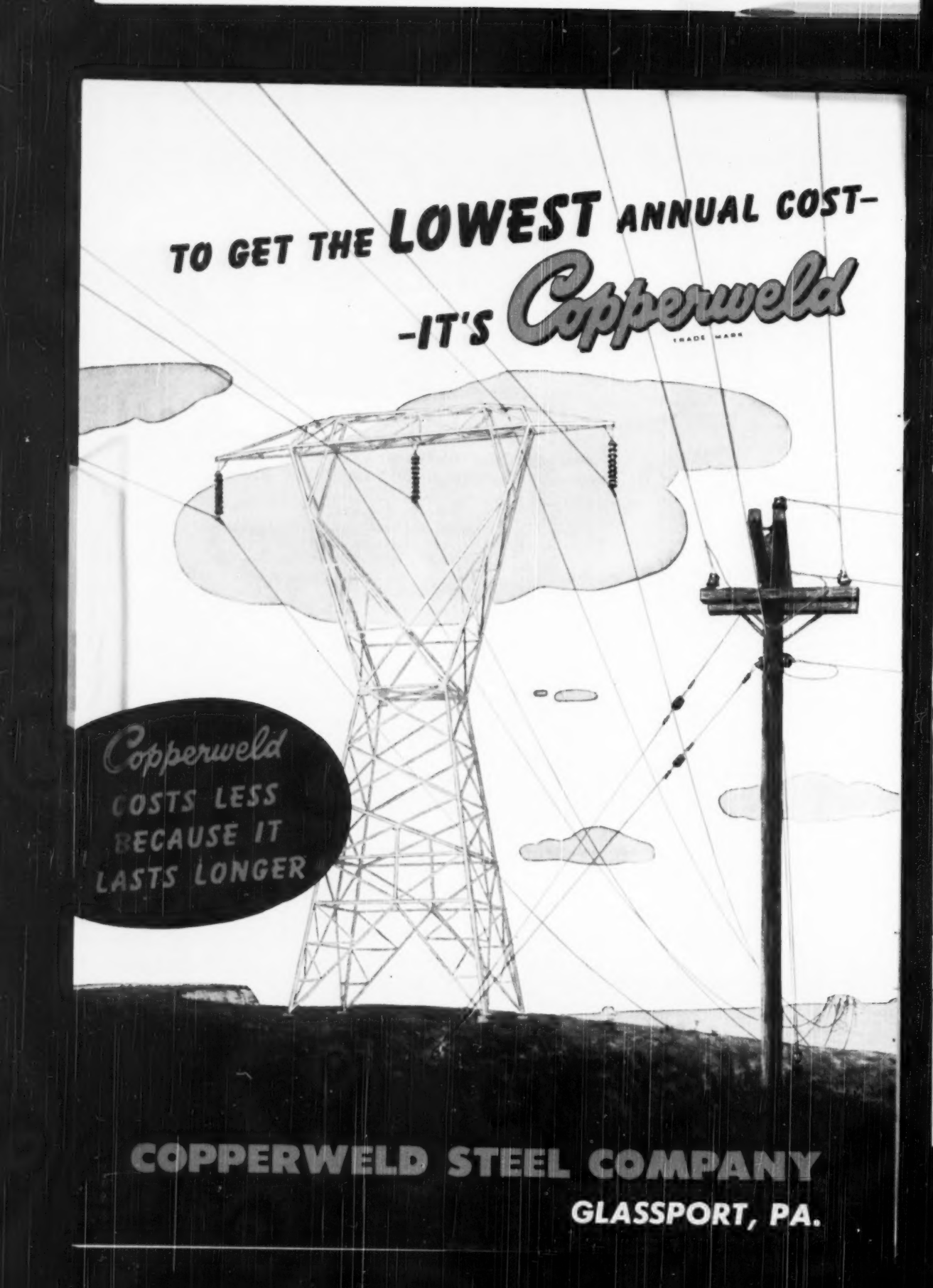
Wagner has a nationwide organization to provide fast, convenient service, with 29 branch offices in principal cities ready to help you with your transformer problems. Bulletins TU-180 and TU-181 give complete information on Wagner Transformers.

T3-9

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES


TO GET THE LOWEST ANNUAL COST–
–IT'S Copperweld
TRADE MARK
Copperweld
COSTS LESS
BECAUSE IT
LASTS LONGER
COPPERWELD STEEL COMPANY
GLASSPORT, PA.

USE THE BEST—

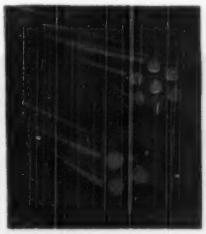
—THE ONLY WIRE COMBINING THE PERMANENCE AND CONDUCTANCE OF COPPER WITH THE RUGGED STRENGTH OF STEEL!

It's a well-established fact that lifetime cost — not first cost — is the only true measure of economy. For 35 years, Copperweld* Products have proved their greater dependability and longer life on thousands of installations. And it's a matter of record that for real economy, Copperweld can't be beat! Why not profit from the experience of others and standardize on Copperweld Products? They'll give you dependable service at lowest annual cost.

*Trade Mark

Copperweld OVERHEAD GROUND WIRE

To reduce outages and provide uninterrupted service, give your transmission lines permanent protection with Copperweld Overhead Ground Wire. Its high strength permits small sags with ample mid-span clearances. Because Copperweld is non-rusting—its original strength remains constant—it lasts as long as the line it protects.



Copperweld GUY AND MESSENGER STRAND

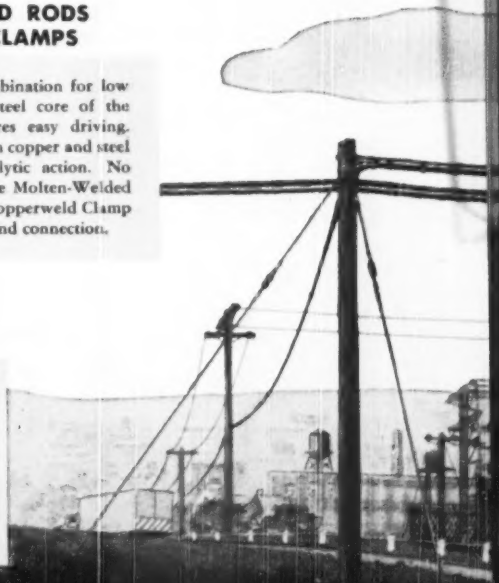
With Copperweld you don't need to buy oversized strand as a protection against later loss of strength caused by rust. Copperweld Strand won't rust—its original high strength is permanent. You save when you buy smaller sizes of non-rusting Copperweld Strand—fewer pounds are needed—and you save, too, by avoiding costly replacements of rusted strand.

Copperweld GROUND RODS AND CLAMPS

Here's the ideal non-rusting combination for low resistance grounds. Stiff alloy steel core of the Copperweld Ground Rod assures easy driving. Perfect interlocking weld between copper and steel eliminates possibility of electrolytic action. No other ground rod has this unique Molten-Welded feature. This rod with a rugged Copperweld Clamp makes a simple, dependable ground connection.

Copperweld-copper POWER CONDUCTORS

Simple copper type designs eliminate special fittings—make installation easier—reduce construction costs. You get extra strength and safety for long spans with rugged Copperweld-Copper Conductors. They have the stamina to withstand heavy ice and wind loads. Their high conductance is a known factor. Long life is assured because each wire is permanently protected against corrosion.

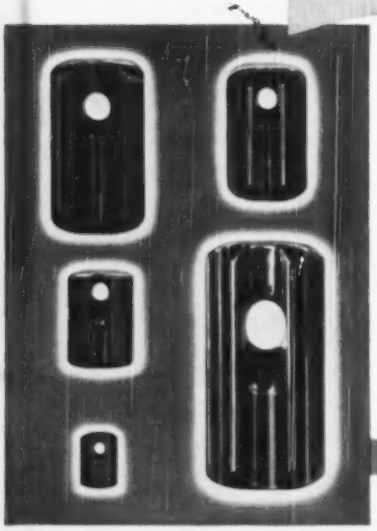


Sales Offices:

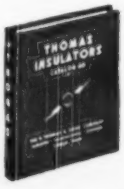
CHICAGO · CLEVELAND · DALLAS · MEMPHIS · NEW YORK · SAN FRANCISCO · ST. LOUIS

STANDARDS of DISTRIBUTION QUALITY

Porcelain Pioneers For 77 Years



No matter what your porcelain insulator requirements, THOMAS can satisfy them . . . whether for high-voltage transmission or low-voltage distribution. Specifically, our distribution porcelain and hardware are backed by the same 77 years of ceramic experience and knowledge which distinguish THOMAS high-voltage suspension and pin-type designs. Consequently, THOMAS porcelain is the standard of comparison for discriminating engineers throughout the Electrical Industry. Make it *your* safeguard for reliable electrical distribution. *Always specify THOMAS—the best by line test.*



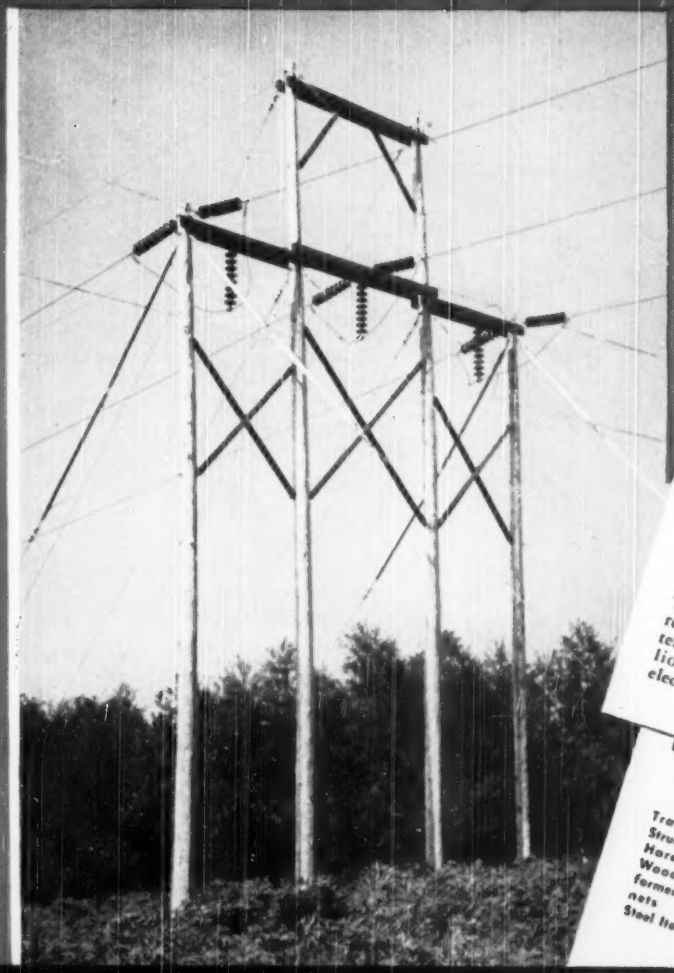
THIS FREE CATALOG

. . . illustrates and describes the complete THOMAS line. Enclosed in a loose-leaf binder, it provides a ready reference for all Transmission-Distribution Insulators and associated Line Hardware. New Insertions, as issued, are sent to all catalog holders.

The R. Thomas and Sons Co.

LISBON, OHIO
NEW YORK CHICAGO
AGENTS IN PRINCIPAL CITIES

Hughes DEPENDABLE X-BRACED TRANSMISSION STRUCTURES



115 KV
Dead End Structure
Type C-11274

Provides for the complete dead ending of conductors and shield wires.

"Hughes" "X" and "K" braces for transverse strength.

"Hughes" wood strain guy insulators, pole bands, and factory assembled double arms.

Consult "Hughes" engineers on your next structure problem.

HUGHES BROTHERS developed and pioneered "X-Braced" construction, worked out the structural theory, and confirmed it by full-sized tests. The results: Thoroughly reliable transmission systems, and savings of millions of dollars for the electric utility industry.

Manufacturers of

Transmission and Distribution Structures • Transmission Line Hardware • Prefabricated Wood Substations • Transformer Platforms • Wood Bayonets • Special Wood and Steel Items.

WHEN IT'S HUGHES *It's Tailored* TO YOUR NEEDS

HUGHES SEWARD FOUNDED - 1921

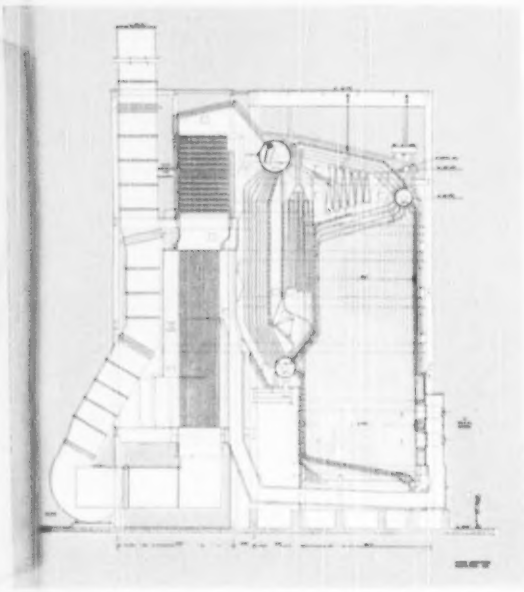
"HUGHES" TRANSMISSION & DISTRIBUTION MATERIAL MEN WOOD METAL

BROTHERS NEBRASKA INCORPORATED

Four RILEY Central

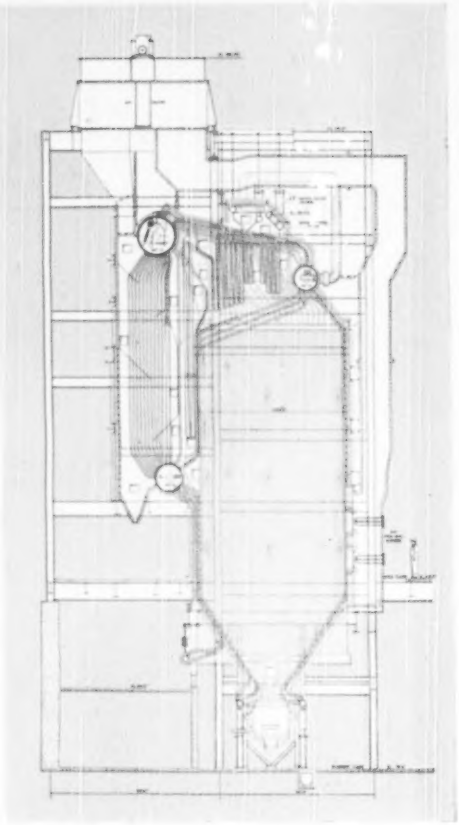
THERE is a very noticeable swing among Public Utilities to Riley Steam Generating Equipment. More and more Public Utility Companies are making their initial installation of Riley equipment and those companies who have tried Riley equipment are, almost invariably, coming back for more Riley units when expanding capacity. More than 70% of Riley's total sales during the past few years has been to public utility companies. Riley has installed or on order over 30,000,000 lbs. of steam capacity in public utility plants.

You Can Rely on Riley



WEST JUNCTION STATION, Houston Lighting & Power Co.
850,000 lbs. hr. 1050 lbs. 905°F.

Houston Lighting & Power Company has installed nine Riley units with a total steam generating capacity of 4,540,000 lbs. per hour.



EDWARDSPORT STATION, Public Service Co. of Ind.
400,000 lbs. hr. 1000 lbs. 910°F.

Public Service Co. of Indiana has installed Riley units at Dresser and Noblesville stations also—six Riley units, total capacity 2,000,000 lbs. of steam per hour. An additional unit is on order for the Edwardsport station.

TRADE MARK Rx REGISTERED

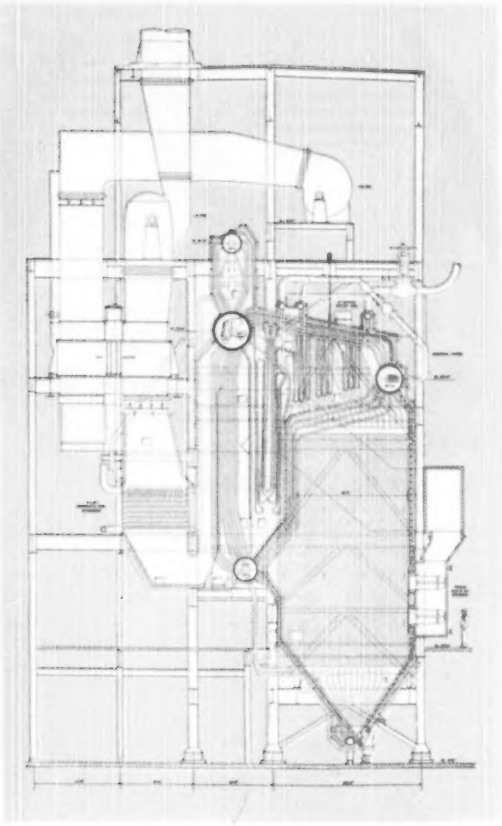
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

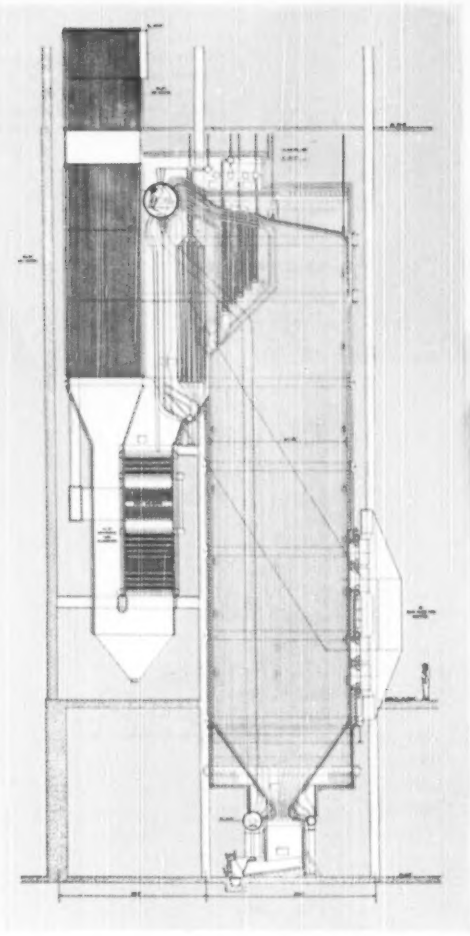
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

Station Installations



HARBOR STEAM PLANT, City of Los Angeles, Calif.
825,000 lbs. /hr. 1200 lbs. 900°F.

There are five Riley units installed at this station, total steam capacity 3,825,000 lbs. per hour.



R. S. WALLACE STATION, Central Illinois Light Co.
600,000 lbs. /hr. 950 lbs. 910°F.

This is the fifth Riley unit to be installed at this station. Four 300,000 lbs. /hr. Riley units having been previously installed. A Riley unit is also installed in their Springfield station.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

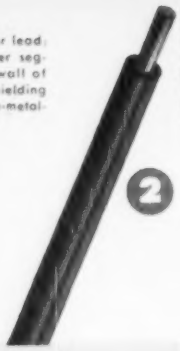
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD [illegible] SETTINGS • AIR HEATERS

FOR CIRCUIT SECURITY IN POWER PLANTS...

Okolite-Okoprene generator lead: Semicon tape protection over segmental conductor, heavy wall of Okolite insulation, metal shielding tape and non-flammable, non-metallic Okoprene sheath.

1



Switchboard and lighting wire at its simplest: Okoloy-coated conductor and Okolite-Okoprene covering (in colors).

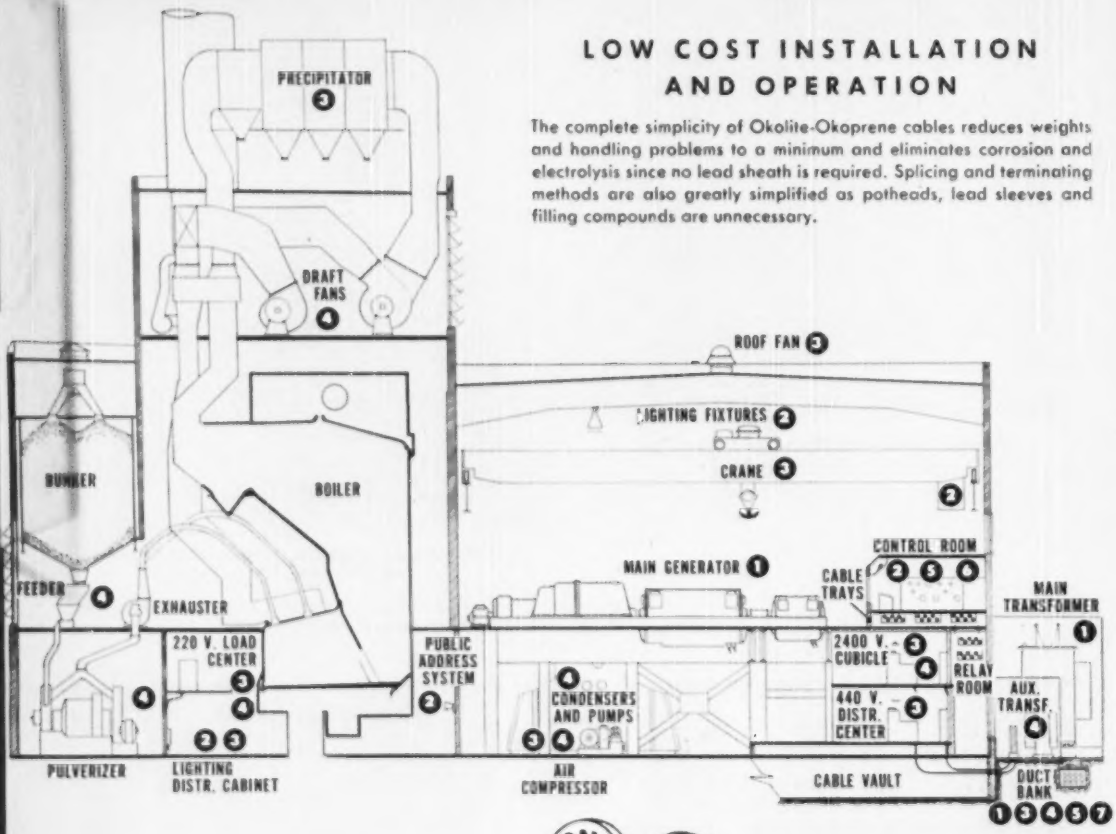
2

For lower voltage power circuits: single conductor Okolite-Okoprene wire and cable in all standard sizes.

3

LOW COST INSTALLATION AND OPERATION

The complete simplicity of Okolite-Okoprene cables reduces weights and handling problems to a minimum and eliminates corrosion and electrolysis since no lead sheath is required. Splicing and terminating methods are also greatly simplified as potheads, lead sleeves and filling compounds are unnecessary.



OKONITE

OKONITE PASSAIC, N.J.

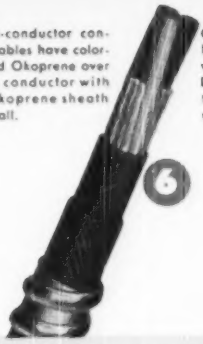
OKOLITE-OKOPRENE STATION CABLES
ARE THE TIME-PROVED ANSWER

4

In all Okolite-Okoprene power cables for use over 2kv Semi-con-Taped conductor prevents internal corona-cutting.

5

Multi-conductor control cables have color-coded Okoprene over each conductor with an Okoprene sheath over-all.



6

Okolite-Okoprene cables can be furnished with interlocked bronze armor where troughs or trays are used.

7

For wet underground runs, lead-sheathed Okolite-Okoprene cables provide extra security (note rubber fillers).

FOR THESE LOCATIONS AND NEEDS...	...OKOLITE-OKOPRENE STATION CABLES PROVIDE THESE PROPERTIES
LONG LIFE AND RELIABILITY All electrical circuits.	Confirming nearly a quarter-century of field experience, continuous aging tests of Okolite insulation checked at intervals in Okonite's proving ground, show practically no change in physical and electrical characteristics. Okolite oil-base insulation, applied by Okonite's strip process, is made with wild Up-river Fine Para rubber established over many years of steady use as stable and dependable. Exposure tests and service records over 13 years have proved the durability of Okoprene coverings.
ELECTRICAL STABILITY All control, power, lighting, switchboard, and communication circuits.	Electrical measurements made on Okolite insulation after 8 years immersion in water show the insulation resistance unchanged from the excellent values recorded in the first 6 months. Insulations made with synthetic rubbers show no such stability. Retention of Okolite's stable electrical qualities is further insured by the Okoprene sheath that seals the insulation from terminal to terminal.
HIGH DIELECTRIC STRENGTH AND OZONE RESISTANCE Generator and transformer leads, auxiliary power circuits, test cables, etc.	Okolite's high dielectric strength is greatly increased by the use of Semicon tape over conductors operating above 2000 volts. Therefore, in addition to a-c. tests at voltages 25% greater than IPCEA requirements, all such Okolite-Okoprene cables are also given a self-imposed d-c. kenetron test at 3 to 4 times the IPCEA 60-cycle a-c. values. Internal and external ozone attack is resisted in 4 ways: (1) Okolite insulation is ozone-resistant, (2) Semicon tape prevents internal corona discharge, (3) Okoprene covering is not only ozone-resistant but (4) does not develop static discharge below 5000 volts.
MOISTURE RESISTANCE Cables in ducts, troughs, or buried direct and wherever condensation exists.	Okolite insulation—*without any lead covering*—has been used for 20 years in submarine power cables, some of which operate at 35,000 volts. From its Okoprene sheath that cannot rot to its conductor coated with Okoloy—the lead alloy that outlasts tinning 2 to 1—an Okolite-Okoprene cable resists attack by moisture.
HEAT RESISTANCE Boiler rooms, tunnels, and other hot locations and for heavily-loaded cables.	Okolite insulation, recommended for use at 75 degrees C up to 8000 volts and 70 degrees C above 8000 volts, is suitable for heavy current loadings or for hot locations. Since equally heat-resistant Okoprene coverings will not support combustion, Okolite-Okoprene cables are also non-flammable, a feature of prime importance in station design.

8054

Neither engineers nor officials can afford to use the key unit in their system—the power plant—as an experimental laboratory. For that reason central station after central station is being wired throughout with Okolite-Okoprene station cables which have time-proved records for reliability and long life. Their vital electrical insulation is oil-base Okolite, made with natural wild rubber, and known for over 20 years for its high dielectric strength, moisture-resistance and stability.

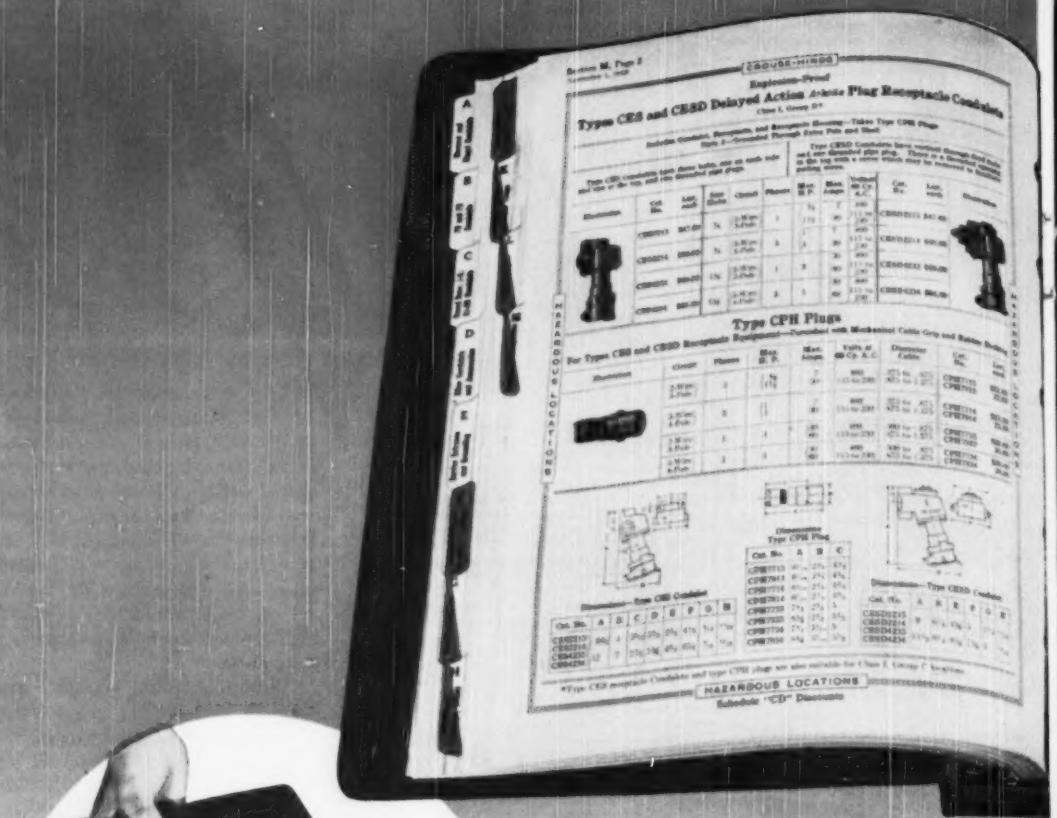
Okolite-Okoprene station wires and cables are available in a complete range of designs from switchboard wire and control cables to heavy, shielded generator leads of the largest dimensions. For circuit identification individual conductors can be supplied with colored Okoprene coverings. Many utilities prefer to use single conductor cables, on reels individually, or wound three cables in parallel, or twisted together without other coverings. Others are obtaining multi-conductor assemblies with an over-all Okoprene jacket.

Okolite-Okoprene cables may be installed in conduit, on trays or racks, buried direct or exposed to the weather. For complete information, including installation records, current carrying capacities, dimensional data and splicing instructions ask your Okonite representative for the Okolite-Okoprene Data File 1-29 or write direct to The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878

insulated wires and cables

CROUSE-HINDS *Announces a*



. . . with many

The many improved features in this catalog are the result of our years of cataloging experience combined with helpful suggestions from users of our products.

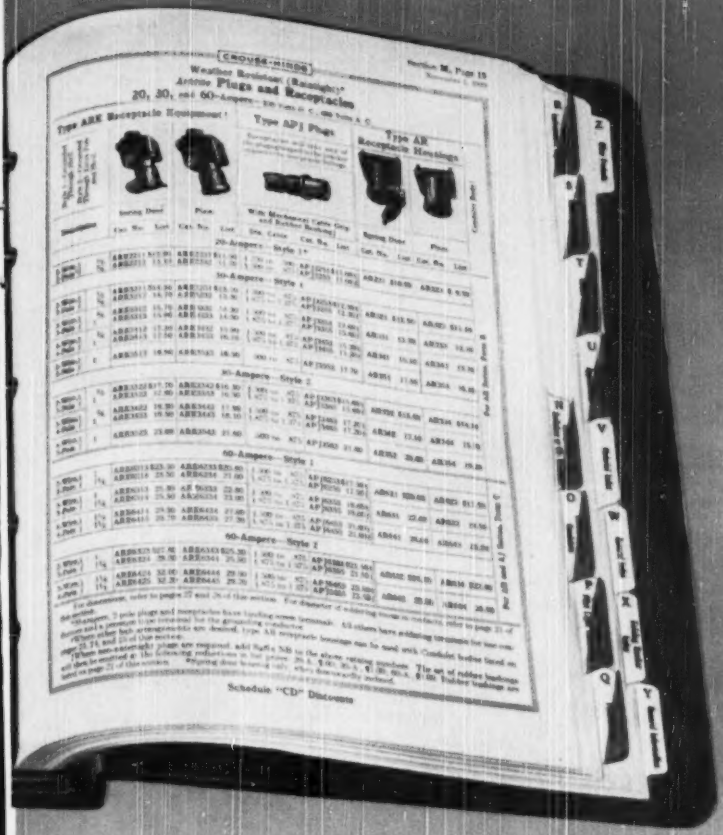
Among the outstanding features of the catalog are the logical divisions of Condulets into sections, the arrangement of the Condulets within the sections and the colored index tabs which simplify its use. For example, Section S contains listings of Condulets for industrial control. Section K contains listings of lighting fixtures

COPYRIGHT 1950 BY CROUSE-HINDS COMPANY, SYRACUSE, N.Y.

CONDULETS • TRAFFIC SIGNALS

NEW CONDULET Catalog

No. 3000



CONDULET
REG U.S. PAT. OFF.
First in the field
STANDARD OF QUALITY

NEW features for your convenience

for general illumination. Section T contains listings of circuit breaker Condulets.

BUFF index tabs identify Condulets for use in non-hazardous locations.

RED index tabs identify Condulets for use in hazardous locations.

Combined RED and BUFF tabs identify Condulets for use in both hazardous and non-hazardous locations.

These features make this catalog a convenient reference book from which to select proper Condulets for required applications.

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

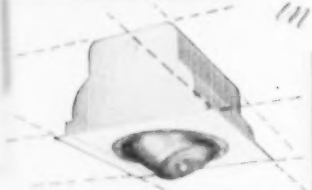
Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. Resident Representatives: Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. — Salt Lake City
CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

AIRPORT LIGHTING • FLOODLIGHTS

Long, Light and Handsome

Leader Slimline-Troffer NHT-280

in various one-piece lengths up to 8 ft.



LEADER Troffer DIRECLITE
This incandescent spotlight may be used between Troffer units in continuous runs or at ends of run, or as individual units. Unique ball and ring assembly provides vertical light adjustment of 45° and horizontal adjustment of 360° for flexible high-lighting . . . Also furnished as incandescent unit with flat diffusing glass or (Holophane Controlens*).

*TRADE MARK REGISTERED

- **beauty through simplicity**
- **flexible light volume**
- **lower installation cost**
- **lower maintenance cost**

Here is a long, symmetrical fixture that "cooperates" enthusiastically with architects and contractors who want to achieve the present-ultimate in lighting beauty and economy. Recessed lighting in extra-long fixtures with a shielding-choice of louvers, baffles, glass enclosures and various special type lenses. Extra length means fewer lamps . . . reduced maintenance cost. Ask us for full details!

SPECIFICATIONS: The LEADER SLIMLINE-TROFFER is wired for 1, 2 or 3 slimline tubes, in 42" to 96" length. Housing and channel of 18 gauge steel. Exterior and end cap finished in rich silver-gray enamel, with high-reflecting white chip-proof baked enamel interior. Extra-sturdy one-piece construction. Instant-start 100, 200, 300 or 425 milliampere operation.

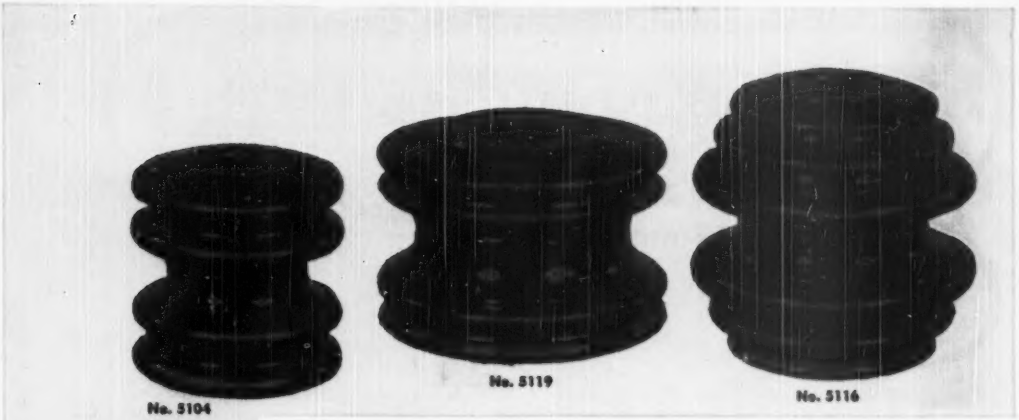
Sold and installed only by the better electrical wholesalers and contractors

Manufactured exclusively by

LEADER ELECTRIC COMPANY

3500 North Kedzie Avenue, Chicago 18, Illinois

Leader Electric – Western: 800 One Hundreth Ave., Oakland 3, Calif.



It Costs No More for the Top Quality Brand...

PORCELAIN PRODUCTS' WET PROCESS SPOOLS

Talk quality. Talk price. Talk features. No question about it. Porcelain Products' wet process spools are the top quality brand at competitive prices. Ask people who use them. Better still, you be the sole judge of their performance. Tomorrow, change that name line on your purchase order to "Porcelain Products". Give this "top quality" claim of ours a test—at no extra premium either.

If you have a special design problem, ...consult us!
If you've never used Porcelain Products' Spools and would like samples, just check off the ones you'd like, fill in the coupon and return to us. If you're an old customer and lack any samples to fill out your line, please fill in the coupon and return it, too.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

ONE OF THE LARGEST PRODUCERS OF SPOOLS

Gentleman:—Please send me without obligation samples and prices of the following spools.

☐ 5101 ☐ 5104 ☐ 5112 ☐ 5116 ☐ 5119

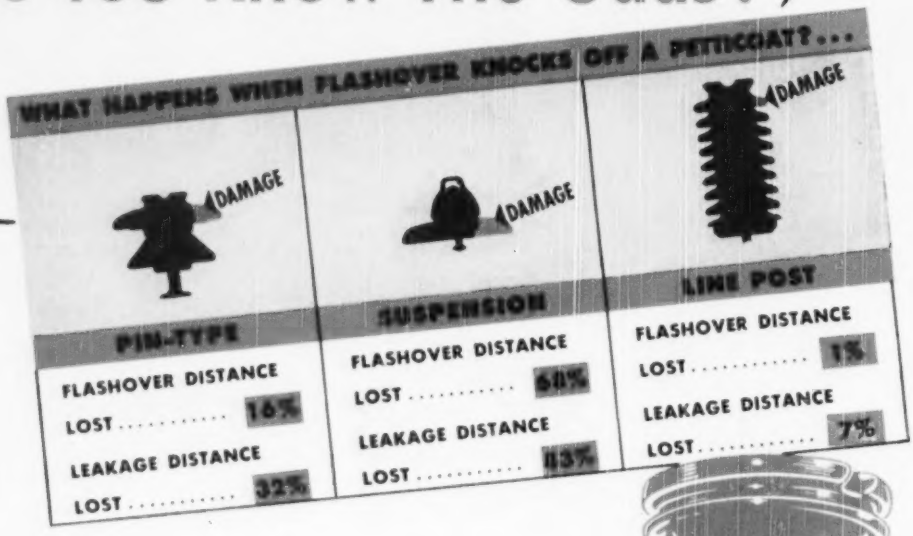
Name_____

Company Name_____

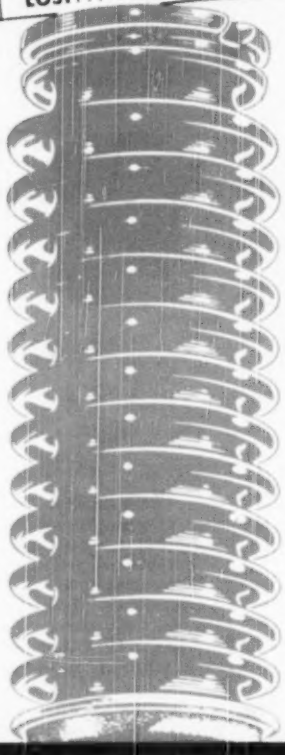
St. Address_____

City_____ State_____

Do You Know The Odds?


WHAT HAPPENS WHEN FLASHOVER KNOCKS OFF A PETTICOAT? . . .
DAMAGE
DAMAGE
DAMAGE
PIN-TYPE
FLASHOVER DISTANCE LOST 16%
LEAKAGE DISTANCE LOST 32%
SUSPENSION
FLASHOVER DISTANCE LOST 60%
LEAKAGE DISTANCE LOST 83%
LINE POST
FLASHOVER DISTANCE LOST 1%
LEAKAGE DISTANCE LOST 7%

HOW many insulators do *you* have to replace in an average year because of flashover damage alone? Actual records *prove* that the replacement rate on Lapp Line Posts is only 1% to 10% that of other insulators. That's because Lapp Line Posts are built for punishment. Flashover attack that would shatter ordinary insulators breaks off one or two petticoats at the most, leaving Lapp Line Posts' body *intact*, flashover and leakage distances only negligibly decreased, essential efficiency *unimpaired*. Small wonder that service records invariably show that *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator*. The odds are all on your side when you build your transmission lines on Lapp Line Posts . . . for maximum performance, maximum economy. Lapp Insulator Co., Inc., LeRoy, N. Y.



PERFORMANCE IS PROOF

Lapp INSULATORS

Year After Year

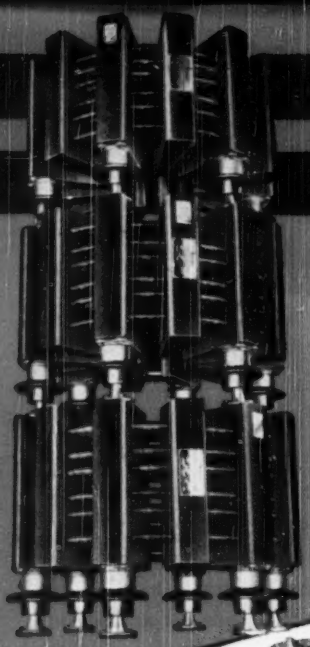
You Can Count On

Dependable Circuit Protection

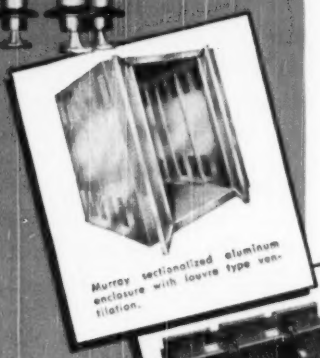
WITH

Murray

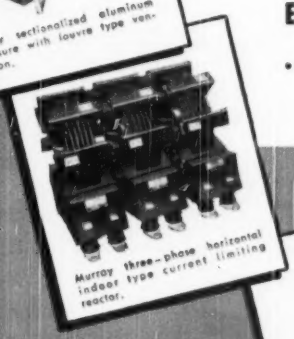
CAST-IN-CONCRETE
Current-Limiting Reactors



Typical Murray three-phase vertical outdoor type cast-in-concrete current limiting reactor.

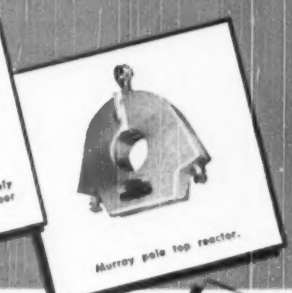


Murray sectionalized aluminum enclosure with louvre type ventilation.



Murray three-phase horizontal indoor type current limiting reactor.

Murray single-phase completely cast-in-concrete vertical outdoor type reactor.



Murray pole top reactor.

Engineered to your specifications...
...for indoor or outdoor service.

Feeder
Generator
Motor Starting
Neutral Grounding
Transformer Equalizing
Special Purpose
Station Tie
Bus Tie
Shunt
} Reactors

Murray

MANUFACTURING CORPORATION

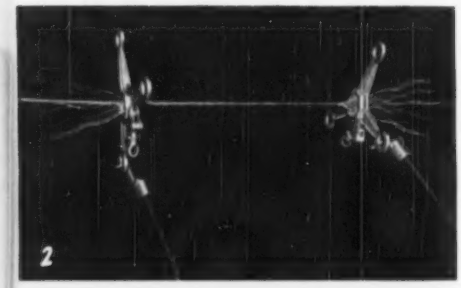
50 Years of Service to the Electrical Industry

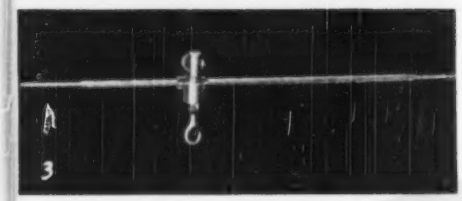
1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

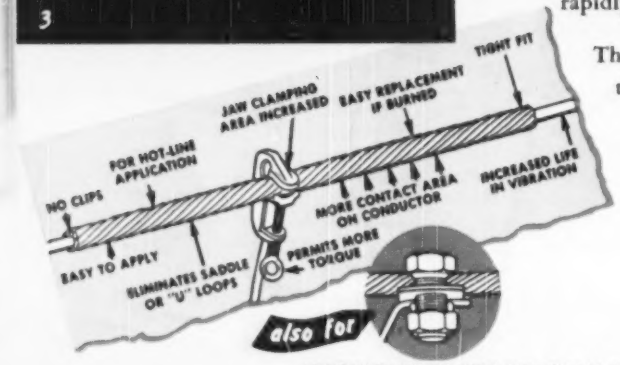
To help you give detailed information on reactors for your individual application, this comprehensive folder has been especially prepared. It provides a reliable guide to points to check in specifying all types of cast-in-concrete current limiting reactors. Write Murray for your copy today.

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS' NEST AERIAL LADDERS

PLP hot-line TAP ARMOR . . . easy to apply—







● Tap-Armor Rods are simply short lengths of PLP Armor Rods. They assure the same simplicity and ease of application. For hot-line taps, they eliminate troublesome concentrations of stresses; prevent arcing and resultant burning of the conductor caused by loosened clamps; and give a positive damping of vibration...one of the main causes of loosened clamps.

FOR COLD-LINE application, simply twist and wipe into place on the conductor as shown by Figure 1. No special tools are needed. PLP Tap Armor grips so snugly that clips or clamps are eliminated.

FOR HOT-LINE application, the set of tools shown in Figure 2 makes the job easy. Safely and rapidly, PLP Tap Armor is put in place.

The result for either hot or cold lines is the same . . . Figure 3. Conductor life is increased, electrical and mechanical characteristics are improved. A COOL clamp is the result.

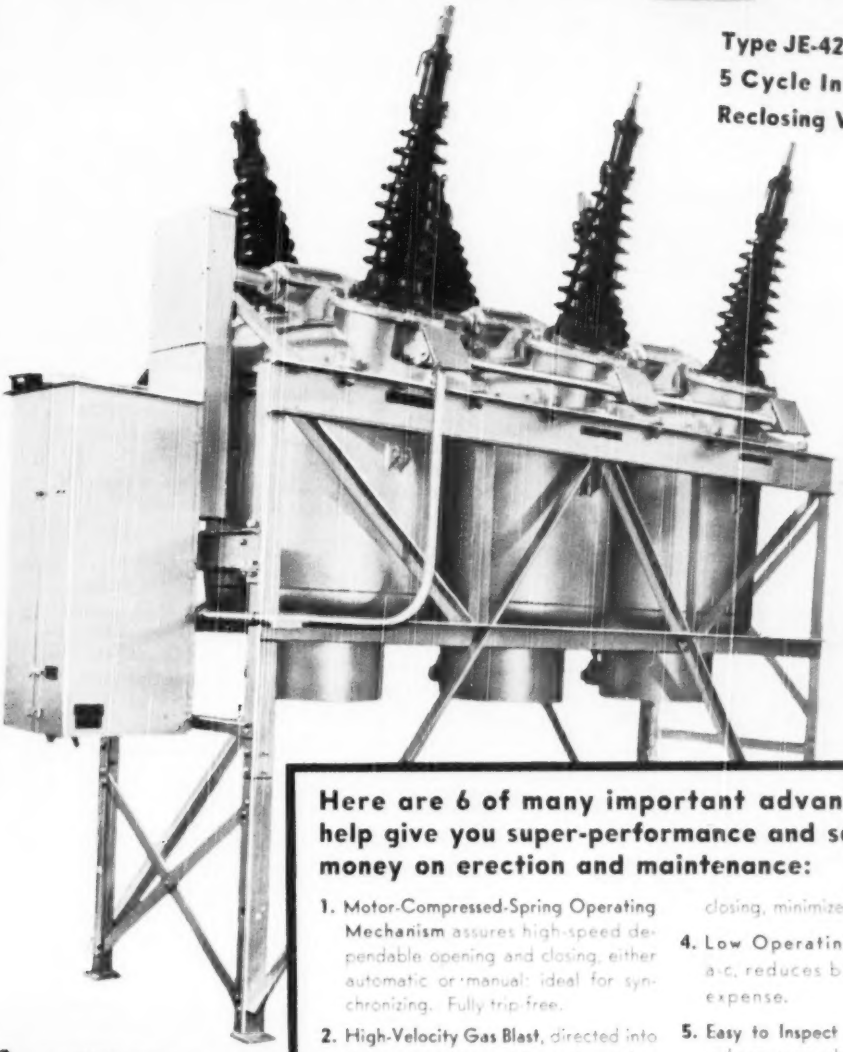
For complete details and a free sample of PLP Preformed Armor Rods, write Preformed Line Products Company.

PREFORMED ARMOR RODS ARE FOR USE UNDER PATENT NO. 2,275,019 — OTHER PATENTS PENDING

PLP COMPANY

PREFORMED LINE PRODUCTS COMPANY
1051 POWER AVENUE • CLEVELAND 14, OHIO

Pacific Electric BREAKERS Have *The Features You Want*



Type JE-42, Rated 69 kv, 8 or 5 Cycle Interruption. Fast Reclosing Within 20 Cycles.

Ratings Available

Type JE-42E
69 kv 600 amps
1,000,000 interrupting kva

Type JE-42F
69 kv 1200 amps
1,500,000 interrupting kva

Type JE-42G
69 kv 1200 amps
2,500,000 interrupting kva

Here are 6 of many important advantages which help give you super-performance and save time and money on erection and maintenance:

1. **Motor-Compressed-Spring Operating Mechanism** assures high-speed dependable opening and closing, either automatic or manual; ideal for synchronizing. Fully trip free.
2. **High-Velocity Gas Blast,** directed into the arc stream, rapidly extinguishes the arc within Pacific Electric Expulsion Chambers.
3. **High-Speed Tripping,** for opening and closing, minimizes dead time.
4. **Low Operating Current,** d-c or a-c, reduces battery or rectifier expense.
5. **Easy to Inspect and Maintain**—Low upkeep even when fault interruptions are abnormally frequent.
6. **Shipped Assembled**—Fully tested and adjusted at the factory.

Get All Facts . . .

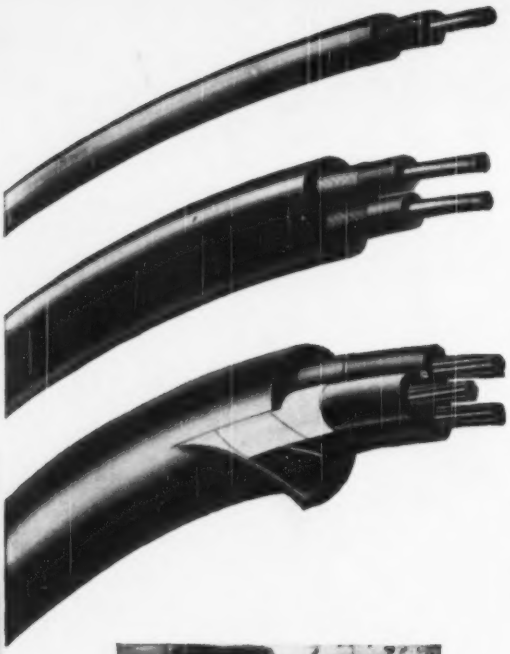
Call

PACIFIC ELECTRIC MFG. CORPORATION

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA • P. O. BOX 419, GARY, INDIANA

C. C. MUSGROVE, 504 Southland Bldg., Annex, Dallas 1, Texas
J. E. REDMOND SUPPLY CO., 825 W. Madison St., Phoenix, Ariz.
G. B. KIRKWOOD, 437 S. Hill St., Los Angeles 13, Calif.
ORMONDE SMITH JR., 3842 Paris St., Houston 4, Texas
PIERCE G. FREDERICKS, 90 West St., New York 6, N. Y.
MARRS & WENDEGATZ, 924 Dwight Bldg., Kansas City 6, Mo.
WILLIAMSON & WILMER INC., 617 Mutual Bldg., Richmond 19, Va.
ELECTRICAL EQUIP. CO., 1847 Madison Ave., Cleveland 7, Ohio
C. H. CUTTER, 912 Securities Bldg., Seattle 1, Wash.
KENT A. HAWLEY, 2324 Elgin Ave., Baltimore 16, Md.
J. C. HARDIE, P. O. Box 411, Des Moines 8, Iowa
ARKANSAS ELECTRIC CO., 716 Louisiana St., Little Rock, Ark.

Other Representatives in Principal Cities



Choose One Type of Power Cable . . . Use it Three Ways

Pick Durasheath for power distribution: small size or large . . . one, two or three conductors . . . to carry from 0 to 5,000 volts. Then use this type in any installation you like: buried directly in the ground . . . in conduit . . . suspended from poles . . . or in a run that includes all three. Following are some of the characteristics of Durasheath that give it this versatility:

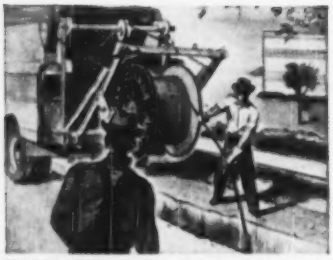
Durasheath is *unaffected by electrolysis*, corrosion and extremes in temperature.

High resistance to oil, flame, abrasion, cutting, impact and the moisture, acids and alkalies found in the soil.

Light weight – greater strength.

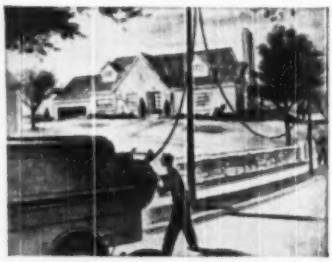
More flexible, easier to handle.

For power distribution between industrial plants, in street lighting systems, airports, mines, railroad signal systems, farm buildings and real estate developments – to mention a few – use Durasheath, the all-purpose cable. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. awm



UNDERGROUND. Toughness of neoprene jacket assures long life of Durasheath when installed directly in the ground.

IN DUCT. Moisture, oil, acid resistance of neoprene jacket make Durasheath an ideal cable for this application.



IN THE AIR. In single or multi conductors, Durasheath truly is a one-type cable for all-type use.

Anaconda **Durasheath**

ANACONDA

THE ALL-PURPOSE CABLE

BLACKBURN *Hi-Strength* CONNECTORS

Make BETTER Connections — HIGH PRESSURE Connections!

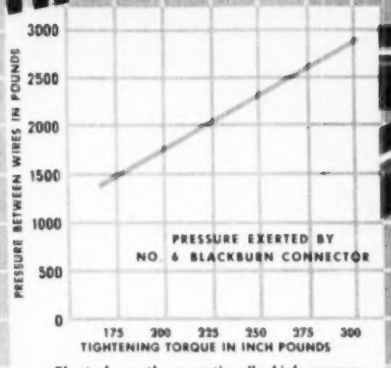
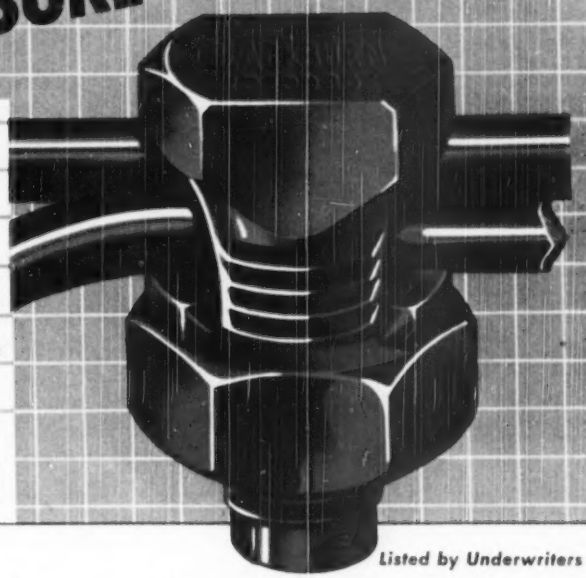


Chart shows the exceptionally high pressure exerted between the contact surfaces of the wires by a No. 6 BLACKBURN Hi-Strength Connector, at various torques.



Listed by Underwriters

HIGH PRESSURE Connections Are BETTER Connections

High pressure increases the contact area between the wires, effectively seals the contact surfaces from moisture and oxidation, and produces a lasting, low-resistance connection.

BLACKBURN Connectors Make Lasting High Pressure Connections because:

(1) They are made with the right combination of alloys — high strength alloys — to reduce frictional losses in the threads.

(2) They are made with smooth-cut threads, to increase their efficiency. These two factors insure more of the tightening torque being converted to "pressure between wires".

(3) Their corners and edges are all rounded, so that the high pressure cannot injure the wires.

(4) They actually test stronger than other connectors when pulled to destruction in a tensile-testing machine. This means that BLACKBURN Connectors have that extra strength required to maintain the high "pressure between wires" without stretching and loosening.

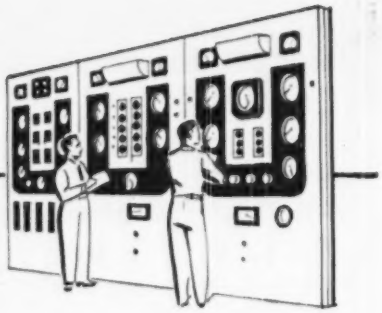
(5) The coefficient of expansion of the alloys used is substantially equal to that of copper. A temperature change of 100° F results in only 1% change in the "pressure between wires".

Yes, BLACKBURN Hi-Strength Connectors definitely *make better connections — for your protection!*

JASPER BLACKBURN PRODUCTS CORP.

Builders of Quality Connectors for 15 Years • First, Madison & Clinton Sts., St. Louis 6, Mo.
Phone CE-3007

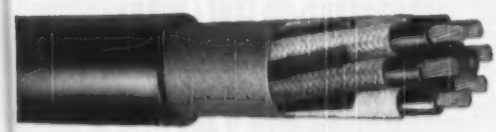
How to STOP CONTROL CIRCUIT FAILURES



Rome Control Cables pay off by preventing failure where it hurts the most . . . in control circuits . . . the nerve center of your power distribution system. They are permanently dependable under extreme service conditions. Rome Control Cables are designed for versatility of application, with outer sheath protection against moisture, sunlight, oil, alkalies, acids, and flame. Installation may be by direct burial, in conduit or duct, in open air, or runs combining all three. Typical control cable constructions embody rubber, Neoprene and thermoplastic compounds. Sign and return coupon below for available size and conductor combinations, and test data.

ROZONE-ROPRENE CONTROL CABLES

A superior quality construction possessing the highest degree of resistance to heat, moisture, corona and ozone cutting. Individual conductors are insulated with RoZone, a high quality oil base compound and are sheathed with Neoprene for complete protection where fanned out at terminals. Assembled with rubber-like fillers and protected over all with a RoPrene (Neoprene) sheath. Recommended for operating temperatures up to 75° C. Rated at 600 V. Ask for Specification CRO-1.



ROMARINE-ROPRENE CONTROL CABLES

Here is the popular combination of RoMarine, a superaging and moisture resistant insulating compound and a RoPrene (Neoprene) sheath. Individual conductors are protected with color coded fibrous braids (or Neoprene when specified) and assembled with jute fillers. Recommended for general purpose control and signal installations for operating temperatures up to 75° C. Rated for 600 V. Ask for specification CRM-1.

ROME SYNTHINOL* CONTROL CABLES

Rome Synthinol Control Cables are the practical answer where thermoplastic insulation and sheath are desired. Rome Synthinol (polyvinyl chloride) is highly resistant to flame, moisture, oils, chemicals, and corrosive fumes. Fanned out conductors are individually protected with Rome Synthinol thermoplastic compound and are permanently coded in clear colors for easy circuit identification. Recommended for operating temperature up to 60° C. Rated for 600 V. Ask for Specification CT-1.

*TRADEMARK REGISTERED

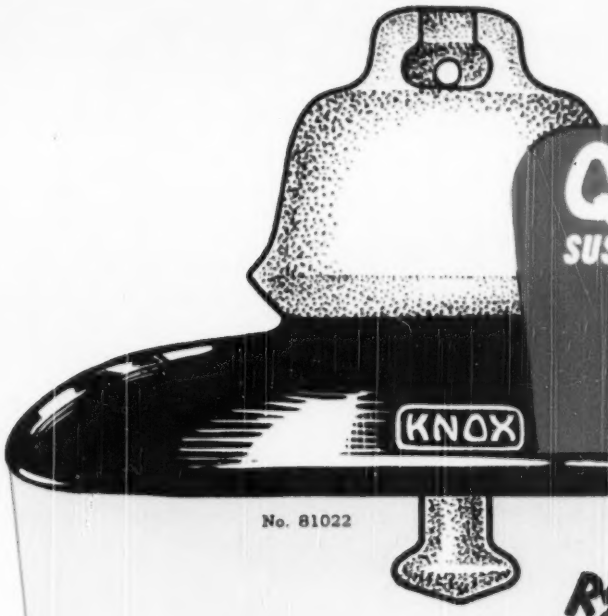
It Costs Less to Buy the Best . . . Buy Rome Control Cables

ROME CABLE CORP., Dept. EW-1, Rome, N. Y.
Please forward Control Cable Specifications as follows

Name
Company
Address
City State

ROME CABLE
Corporation
ROME · NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.



QUALITY
SUSPENSION INSULATORS AND PINTYPES BY KNOX

No. 81022

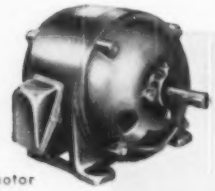
R.E.A. APPROVED

Ever see high voltage insulators made? Some day soon drop in on the boys at **KNOX** — you'll be surprised how zealously they maintain their quarter-century reputation for producing top quality electrical porcelain! From the word go, all guess work is eliminated. Highly trained ceramic engineers take pride in exacting production procedures, uniform firing and rigid Standard Laboratory Tests for tensile strength, cantilever, porosity and impact. Skilled electrical engineers make absolutely positive of high puncture and flashover ratings by putting each unit through exhaustive American Standard Insulator Tests. That's why **KNOX** insulators are electrically and mechanically strong, assuring permanent insulations at lowest maintenance costs.

SEND FOR NEW CATALOG NO. 9

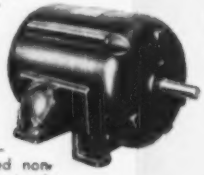
KNOX PORCELAIN CORP. • KNOXVILLE, TENN.

NOW IN MOTORS
IT'S ELLIOTT ALL THE WAY



The BA protected-type motor has drip-proof enclosure.

The BA squirrel-cage splash-proof motor.



The BE totally enclosed non-ventilated squirrel-cage motor.

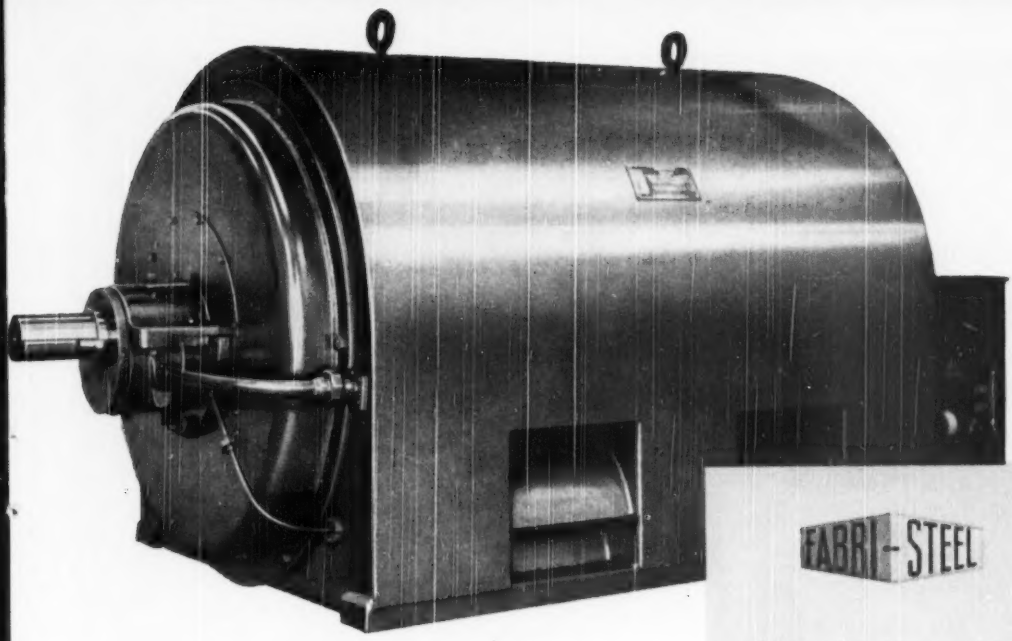
SEALED-POWER totally-enclosed fan-cooled motor (Form CFC).

This soundly established and complete line of motors includes practically every type and variation in small and medium-size motor listings. NEMA specifications and standards are rigidly adhered to.

The motors shown at left are typical C-W products. The BA line, squirrel-cage protected-type, has enclosures suitable for a variety of conditions in which drip-proof and splash-proof constructions are essential. The Form BE motors are totally enclosed, have no ventilating openings, and are cooled by surface radiation. Form CFC are the popular Crocker-Wheeler "Sealedpower" motors, completely enclosed. They are cooled by a constant stream of air blowing across the fins of a distinctive fin-type frame, which has 150% more heat-radiating surface than conventional fan-cooled motors.

For complete data on these and other motor types, write for bulletins.

ELLIOTT COMPANY



FABRI-STEEL

FROM 1 hp. -*up*

The Well-known CROCKER-WHEELER line of motors in capacities from 1hp up is now added to the equally popular ELLIOTT "Fabri-Steel" line of large motors in capacities from 250 hp up.

This means that under a single responsibility you can now get any motor you need from the smallest NEMA integral horsepower frame in a wide range of types, to the big, smooth-running all-steel Elliott motor that has made motor history during the past few years, replacing the familiar cast frame and bracket type motors of the past.

Make your motor problem an Elliott problem—talk it over with an Elliott motor engineer. Informative bulletins on request.

The all-steel construction of these motors together with a number of other Elliott developments, has set up new high standards of motor performance and operating economy, due to exceptionally rigid strength, general ruggedness and easy maintenance. The FABRI-STEEL two-pole induction motor, illustrated above, is typical of the line. It is available from 250 to 4000 hp, 3600 rpm, in types for normal or high starting torque and low starting current, easily accessible split-sleeve bearings, in various enclosures—drip-proof, splash-proof, enclosed, self- or separately-ventilated and with built-in coolers. The Fabri-Steel line also includes Elliott high-speed induction motors, 4 to 14 pole, 1800 rpm and slower, as well as high- and low-speed synchronous motors designed for specific service requirements, all with similar mechanical design and all-steel construction.

RIDGWAY DIVISION . . . RIDGWAY, PA.
CROCKER-WHEELER DIVISION, AMPERE, N. J.
Plants in JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, OHIO • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

E-700

from the
Land of "MIGHT"
SOARING far above crag and peak, the eagle seeks his nest—so high as to be almost beyond man's reach! And yet, Smith Impulse Turbines, designed for high heads and locations presenting natural barriers, take more than the Gold of Midas from the eagle's realm, by transforming the force of falling water into mechanical energy! Write for Bulletin 147.
S. MORGAN SMITH COMPANY
YORK, PENNSYLVANIA • U.S.A.
POWER by SMITH

Statistics will show that the majority of breakdowns in the electrical industry are those of RESOLUTIONS—

To help uphold new resolutions on product quality
THESE TECHNICAL SERVICES ARE AVAILABLE

1. Research 2. Testing 3. Analysis 4. Inspection 5. Surveys 6. Statistics

ETL Know by Test—

ELECTRICAL • MECHANICAL • PHYSICAL • PHOTOMETRIC • RADIOMETRIC • CHEMICAL

Electrical Testing Laboratories, Inc.

HEADQUARTERS AND LABORATORIES
2 EAST END AVENUE AT 79TH STREET · NEW YORK 21.
BUTTERFIELD 8-2600

ELECTRICAL AND GENERAL TESTING · INSPECTIONS · RESEARCH · CERTIFICATION

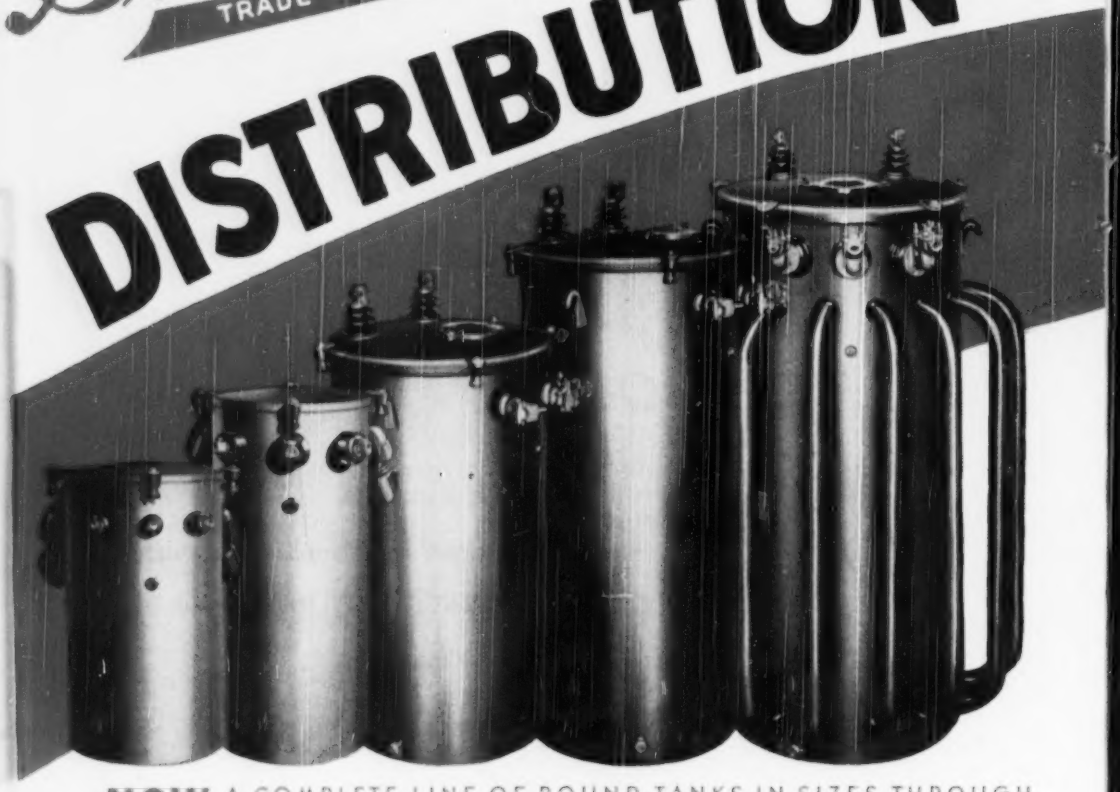
BUILT BY

Standard

TRADE MARK ®

ACCEPTED BY PEOPLE WHO KNOW FROM EXPERIENCE

DISTRIBUTION

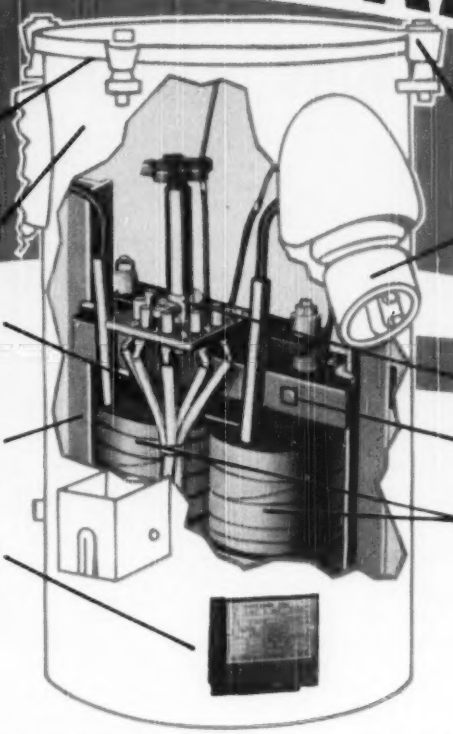


NOW A COMPLETE LINE OF ROUND TANKS IN SIZES THROUGH 100 KVA FOR POLE OR CROSS-ARM MOUNTING . . . . .

- **Heat dissipated twice as fast because of:**
  - (1) Greater coil surfaces
  - (2) Freer circulation of oil
- **Greater protection to transformer because of:**
  - (1) More clearance and insulation to prevent flash-overs
  - (2) Coil impregnation with elastic varnish
- **More durability of tanks because of:**
  - (1) Fabrication from heavy copper-bearing steel
  - (2) Butt-lapped and welded for strength and leak-proofing
- **Cylindrical design because of:**
  - (1) Convenience in handling and installation
  - (2) Better appearance of installations

All Standard transformers are built to or above requirements of EEI NEMA, ASA and AIEE. Stock or special designs for your specific requirements may be had from STANDARD in STANDARD's proven quality.

TRANSFORMERS



1 Cover gasket of Neoprene gives complete moisture-proof seal and prevents oil leakage. Each unit pressure tested.

2 Tank of copper-bearing steel with seams electrically welded.

3 Core assembly of non-aging, low-loss, varnish coated silicon steel sheets, sheared and annealed to reduce core losses.

4 Steel T-bars welded to tank for easy insertion or removal of element assembly. Prevent movement in tank.

5 Name plate pad positioned and designed in accordance with ASA standards. Space provided for users plate.

6 Cover readily removed for loosening and exciting hold-down fingers. Entire interior is thus exposed.

7 High voltage porcelain type bushings are brown glazed, wet process porcelain with [illegible] connectors. Co-ordinated so that flash-over will occur externally rather than internally.

8 [illegible] changing switch.

9 Well-designed core clamping assures quiet and efficient operation.

10 Coil wound in two sections doubles heat radiation. Ends not blanketed, thus inducing free and effective oil circulation.

WRITE FOR BULLETIN S-401A

STANDARD's major contribution to the industry has been in the field of special design for difficult specifications. This experience assures you of maximum know-how that, when applied to distribution transformers, provides extra quality.

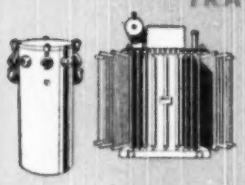
The extent of our representation affords you rapid answers to transformer problems — write today for the name of your near-by Standard representative. He is qualified to give you information on any type transformer and our service.

Offices in Principal Cities

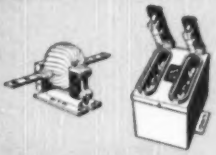
THE STANDARD TRANSFORMER CO.

WARREN, OHIO

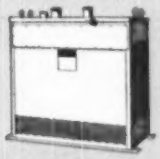
TRANSFORMERS FOR EVERY APPLICATION



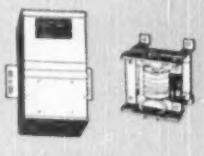
Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)



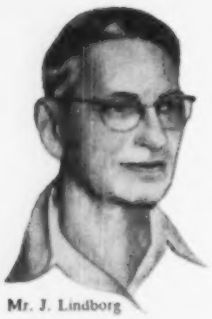
Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)

users say

G. E.'S NEW ALL-PURPOSE* INSULATING VARNISH G-E 9574



Mr. J. Lindborg

From all parts of the country, enthusiastic reports are pouring in from users of G. E's new general-purpose varnish G-E 9574.

Here's a typical statement from J. Lindborg, owner and operator of AAA Electric Motor Service, Atlanta, Ga.

"Our experience has been that this varnish is as good as G. E. claims. It gives a good coat on every type of wire, bakes easily and dries to a tough coating that stands up perfectly in service. Also, this varnish works excellently with all types of coated wire and does not damage the insulation. We like the thinner, petroleum spirits, since it is cheap and can be purchased locally.

"During the two years we have been using this varnish we have had no complaints from any of our customers concerning our work."

IF YOU HAVEN'T YET TRIED G-E 9574, get in touch with your local G-E Distributor, or write for our new bulletin to Chemical Department, General Electric Company, Pittsfield, Massachusetts.

..."bakes easily"*

..."on every type of wire"

..."stands up perfectly in service"

*G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G. E.'s complete line of electrical insulating materials.

You can put your confidence in

GENERAL ELECTRIC

Diagnose Transformer Trouble

in the field

reduce delay and expense

spot trouble while in service position

THE BIDDLE TRANSFORMER TURN RATIO TEST SET is a *New Tool* in transformer work

It is designed for use on power and distribution transformers, including auto-transformers.

It provides *for the first time* a portable device for measuring turn ratio with high precision.

It can be carried anywhere, to the top of large transformers, in the transformer shop or stock location.

With it you can:

- Measure the turn ratio of new, repaired and rewound units, both power and distribution types.
- Check polarity.
- Quickly identify leads and taps.
- Check tap-changer settings.
- Investigate load division and circulating current between units or banks.
- Detect shorted or missing turns.
- Locate concealed faults.

The "TTR" Set is essentially a reference transformer with characteristics—in respect to measurements of turn ratio—that match those of the power and distribution transformers you desire to test. Its ratio is adjustable from 0 to 130 and measurements are easily obtained by direct reading from the indexes of four dial switches using the null-balance comparison system. It features a hand-cranked, 8-volt a-c generator which renders it independent of any outside source of current. Hence, it is a safe and practically shock-proof, one-man instrument.

Owners of the "TTR" Set tell us that in the short time they've used it, it has paid for itself in analyzing conditions in transformers during manufacture, at installations, and in maintenance and trouble work. For the price, and more detailed descriptions of the "TTR" Set, we invite you to send for Bulletin 55-W.

JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

1316 ARCH STREET, PHILADELPHIA 7, PA.

"Megger"® INSULATION TESTERS • GROUND TESTERS • OHMMETERS

APPROVED FOR

▼ A *shallow trench* is all you need for U·S·S Amerite-Amerprene Cables. You save the cost of an expensive conduit system.

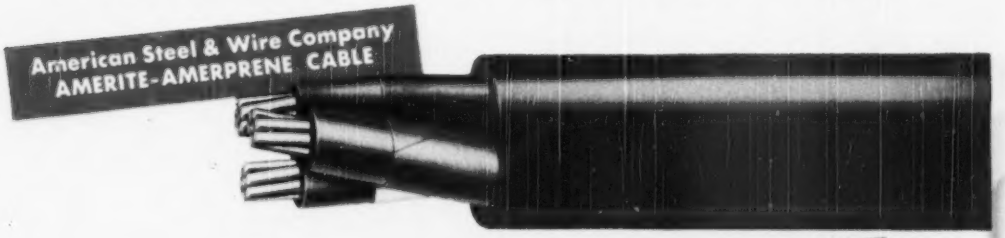
▲ *Runway lights*, boundary lights, street lights and building lights can all be operated through Amerite-Amerprene Cable.

▼ *Installation is simple* under existing runways—drill a hole and pull the cable through. No rigid conduit is needed.

AIRPORT WIRING

by

Civil Aeronautics Administration



THESE two types of U·S·S American Electrical Wire and Cable have been approved by the Civil Aeronautics Administration under specification L-824 for underground airport wiring.

No conduit is needed for these cables. Their insulated conductors are encased in a tough, resilient jacket of Amerprene — a polychloroprene compound that is highly resistant to moisture and soil fluids as well as to mechanical abrasion. Amerprene-sheathed cables can be laid in an open trench and will give reliable service even in soggy ground.

AMERITE-AMERPRENE CABLE is approved as Type A —Style RR for 600, 3000 and 5000 volts. Excellent insulating and physical properties are combined in a single cable.

AMERZONE-AMERPRENE CABLE is approved as Type B—Style ROR for 3000 and 5000 volts. This cable utilizes an ozone-resistant type of insulation.

Both cables are available in single and multiple conductor construction in all sizes commonly used for airport work.

PS Shielding with conducting tape

In addition to these specific designs, we regularly furnish similar constructions for either direct burial or aerial service at even higher voltages. For many applications, our engineers recommend Type PS non-metallic shielding, supplemented by bare copper ground or drain wires. This unique method of shielding is designed to protect workmen from injury, and to prevent possible damage to the rubber insulation from the effects of corona or ionization.

Write for specifications

Amerite-Amerprene and Amerzone-Amerprene Cables are among the first approved by the Civil Aeronautics Administration for use in the new airport building program. Any office of the companies listed below can supply you with detailed information on these two types of cable.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

AMERCLAD ELECTRICAL WIRE & CABLE

UNITED STATES STEEL

Rush problems solved with Mallory Contacts and rapid-fire analysis!

Mallory bridges the gap of time when customers signify a vital need for immediate attention.

Typical is the case of a manufacturer of electrical devices for household use . . . with a complex contact problem that had to be solved in a justifiable hurry. Within eight hours, Mallory's shirt-sleeve approach had accomplished the following: the device was reviewed and proper contact material specified . . . the contact design was modified for more economical production . . . costs were analyzed and quantity price was submitted.

At a later date, the customer received additional help . . . spectrographic analyses of materials other than contact materials, leading to further product improvement for this customer.

That's service beyond specifications!

This same Mallory service is available to anyone, whether the problem is electrical or metallurgical. What Mallory has done for others can be done for you!

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Elkonite* Contacts

Elkonite is the trade name for a series of contact materials developed by Mallory and manufactured from metal powders. They are best known for their hardness, resistance to mechanical wear and impact, resistance to erosion by arcing, and resistance to sticking.

Elkonite contacts are made by the only method which permits the combining of the desirable features of basic metals which cannot be alloyed. By this means, the high melting points of tungsten, molybdenum, or their carbides, can be combined with the current-carrying ability of silver and copper.

*Reg. U. S. Pat. Off.

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Contacts
Controls	Resistors
Rectifiers	Vibrators
Special Switches	Power Supplies

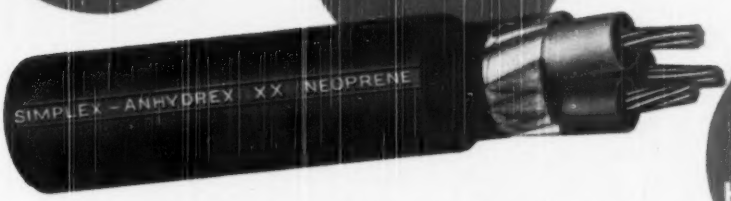
Resistance Welding Materials

now for the first time...

...A HIGH-VOLTAGE INSULATION WITH ALL THE PROPERTIES NECESSARY FOR TROUBLE-FREE SERVICE UNDER ALL OPERATING CONDITIONS...

LOW WATER ABSORPTION

OZONE RESISTANCE



RESISTANCE TO HEAT and AGING

SIMPLEX-ANHYDREX XX

Here at last, in the new Anhydrex XX insulation, is the combination that assures dependable, low-cost cable performance under all conditions of high-voltage service. And in Anhydrex XX none of the effectiveness of one property has been sacrificed to gain the others.

Aged in an air oven for sixteen weeks at the grueling temperature of 250 F. (121 C.) Anhydrex XX remained rubber-like in quality and appearance, was still suitable for continued use. It retained approximately half of its tensile strength, nearly two-thirds its elongation. Most important of all, its rate of deterioration after the first few weeks was very slight, indicating exceptional stability and long life.

Ordinary oil base and heat-resistant compounds could not match this performance. Inside of only three weeks both had become brittle and, upon bending, immediately cracked and crumbled.

Aged at the same high temperature for seven days, Anhydrex XX was immersed for a week in distilled water at 158 F. (70 C.). It would not absorb more than 15 mg. per square inch of exposed surface. Bent around a mandrel, it was exposed to .03% ozone for four hours yet would not crack.

Anhydrex XX is the only insulation that provides this valuable combination. So that you may determine fully the effectiveness and stability of these properties even after years of service, we have drawn up an ironclad specification for Anhydrex XX which we will gladly send you upon request. Simply fill in and mail the coupon below.

SIMPLEX WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.

GENTLEMEN: PLEASE SEND A COPY OF SPECIFICATION 1605 TO:

NAME _____ TITLE _____

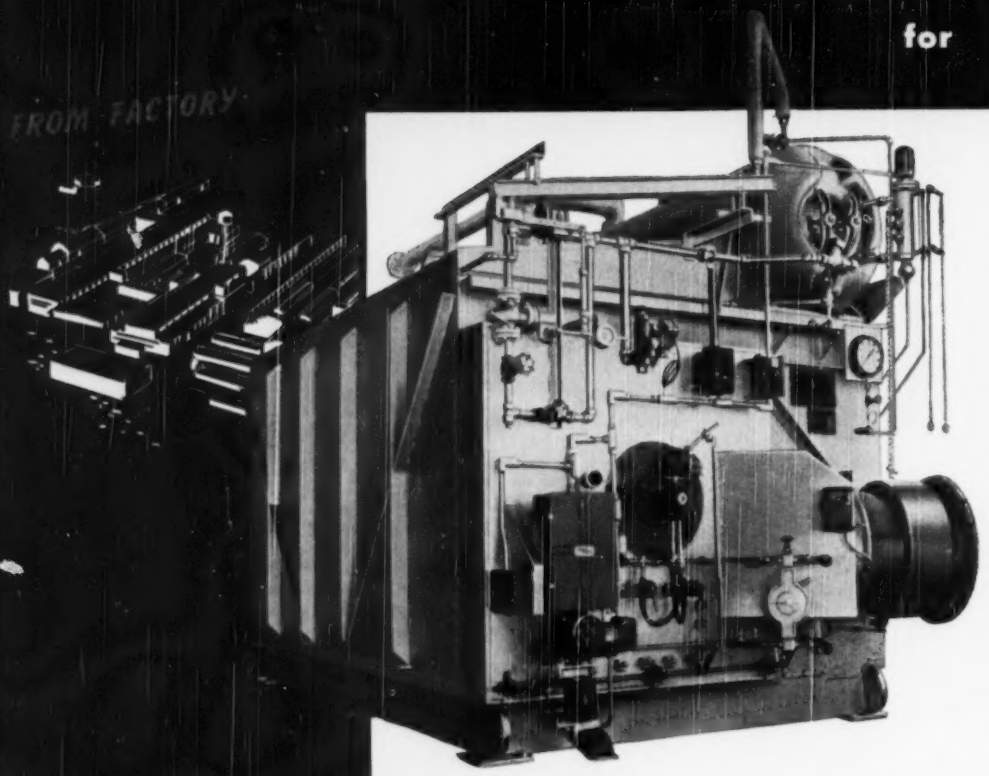
COMPANY _____

STREET _____

CITY _____ STATE _____

Water-tube Steam Generators

Foster Wheeler Package for



FACTORY ASSEMBLED STEAM PLANTS—Industry's need for small but efficient plants to supply power or process steam is fulfilled by Foster Wheeler *factory assembled water-tube steam generators* which can be shipped by common carrier, (truck, rail, or water) and readily installed. The labor necessary for installing a packaged unit is for the most part limited to service connections.

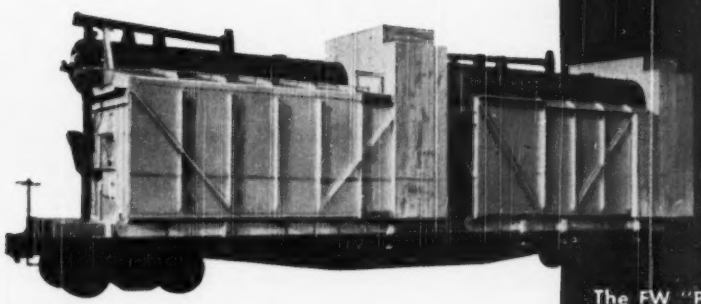
Foster Wheeler Package Steam Generators reflect the high engineering standards of an organization with over 50 years' experience in the art of steam generation and the manufacture and erection of power plant equipment. Therefore the purchaser of a Foster Wheeler Package Steam Generator is assured of skilled erection with proper assembly of any auxiliary equipment, high economy of steam production with any type of fuel, and efficient operation.

FOSTER WHEELER CORPORATION · 165 BROADWAY, NEW YORK 6, N. Y.

Assembled,—Then Shipped

Units up to 35,000 lb per hr

Coal, Oil, or Gas Firing



Write for a copy of Bulletin PG-49-13c which contains drawings, sizes, and descriptions of Foster Wheeler Package Steam Generators.

The FW "Package" Contains

All These Features

Completely Factory Assembled.

Design pressures 300-500-900 psi.

Simplified water cooled furnace construction with low furnace temperatures.

Generous combustion chambers with low Btu release per cu ft of furnace volume for all types of fuel.

Positive natural circulation.

High thermal efficiency.

Choice of manual, semi-automatic or fully automatic controls.

Steel encased construction.

Drums with large volumes—manholes at both ends—factory-applied insulation.

Attractive exterior finish.

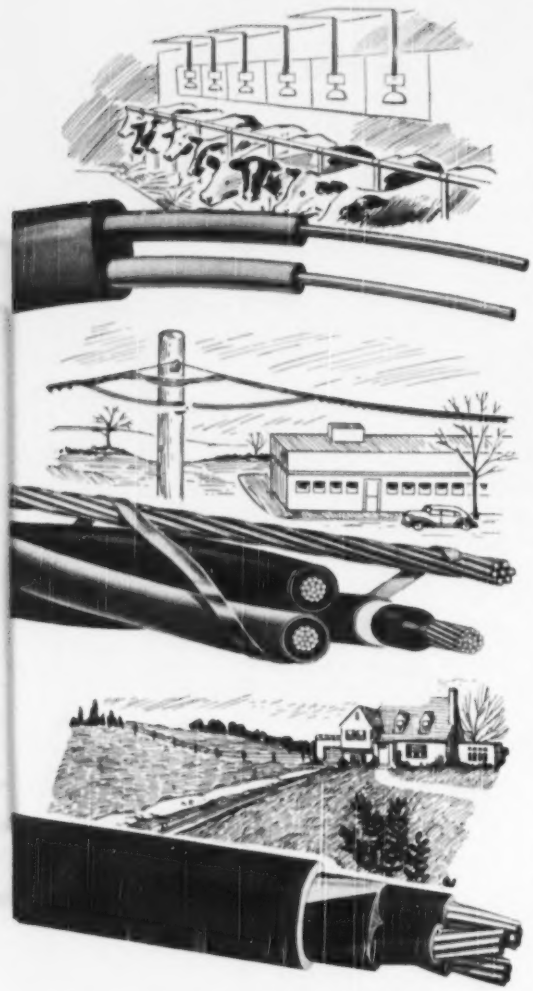
Minimum heat loss from radiation and air infiltration.

Sizes from 1500 to 35,000 lb per hr are plant assembled or field erected at customer's option.

Sizes from 40,000 to 50,000 are field erected only.

FOSTER WHEELER

Here's why so many types of cable are jacketed with NEOPRENE



Barn wire resists rotting, fungus and flame—is easy to install

Cable engineers solved the problem of early deterioration of non-metallic sheathed cable in farm buildings by developing this new neoprene-jacketed barn wire. The neoprene jacket, serving also as insulation, protects the cable against attack from moisture, ice, fungus, rot and ammonia-laden air usually present in barns, stables and other farm utility structures. What's more, neoprene is flame-retarding. And its resistance to abrasion protects cable from cutting and scraping during and after installation.

Aerial cable withstands sunlight, ozone, weather, moisture, chemicals and heat

For all-round protection of this new self-supporting aerial cable, the manufacturer equips it with a jacket of Du Pont neoprene. The neoprene withstands sunlight, weather, ozone, heat and cold . . . resists chemical vapors, oils and grease. It stands up under abrasion from trees and rough surfaces. And the smooth neoprene jacket provides higher dielectric strength for the cable . . . prevents damage caused by static discharge.

Underground cable resists corrosion, rot, vibration, crushing, oils and greases

When electric cable goes underground, it's protected by a jacket of the same tough, durable neoprene that withstands weather so well on overhead installations. For below the earth's surface, resilient neoprene acts as a protective armor against crushing and denting by settling earth . . . absorbs vibration shocks. And it is undamaged by acid or alkaline soil; resists the deteriorating effects of galvanic action.

Tune in to Du Pont "Cavalcade of America," Tuesday Nights—NBC Coast to Coast

FREE! THE NEOPRENE NOTEBOOK—Interesting stories . . . new, unusual applications of neoprene. Write . . . E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division G-2, Wilmington 98, Delaware.

DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

SPECIFY CABLE JACKETED WITH

NEOPRENE

The rubber made by Du Pont

Glendale Auditorium,
Glendale College, Calif.
Architect:
George Lindsay, Glendale
Fixture Manufacturer:
C. W. Cole & Co., Inc.,
Los Angeles
Electrical Contractor:
Victory Engineering &
Electric Co., Los Angeles
Glass:
PYREX brand Lenslites

Your most precise medium for Prismatic Light Control...

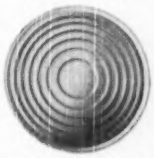
PYREX brand Lenslites

This installation illustrates how effective PYREX brand Lenslites are for controlling light. The problem involved the illumination of an auditorium to an intensity great enough for study purposes but at the same time providing dimmer control of the lighting for use during dramatic productions. The room is 82 feet wide by 85 feet long with an average ceiling height of 24½ feet. Using 300 watt lamps, the average reading is 23½ foot candles, an efficient lighting job.

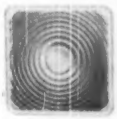
PYREX brand Lenslites permit wide design flexibility for special incandescent lighting effects and are available in both round and square types. With them, light can be concentrated, spread or the beam offset.

CORNING brand Lens Panels are basically Fresnel lenses in cross section, with prisms running parallel with the light source. Made of high quality crystal glass, they are available in a number of sizes and focal lengths to provide any light pattern you desire—concentration, spread or offset beam.

Bulletin LS-17 describes this lighting-ware and gives complete specifications.



Round Pyrex brand Lenslites —6⅝", 8⅝", 11¼", 13¾" diameter—all wide angle.



Square Pyrex brand Lenslites —6½" conc., 8" conc., 8" wide angle, 12" conc., 12" wide angle.

CORNING GLASS WORKS
CORNING, NEW YORK
Corning means research in Glass

FOR EFFICIENT, ATTRACTIVE LIGHTING . . .
CORNING ALBA-LITE for diffusion of fluorescent light . . . CORNING FOTA-LITE for high level illumination . . . PYREX brand LENSLITES and CORNING brand LENS PANELS for prismatic light control

Corning Glass Works, Dept. EW-1, Corning, N.Y.

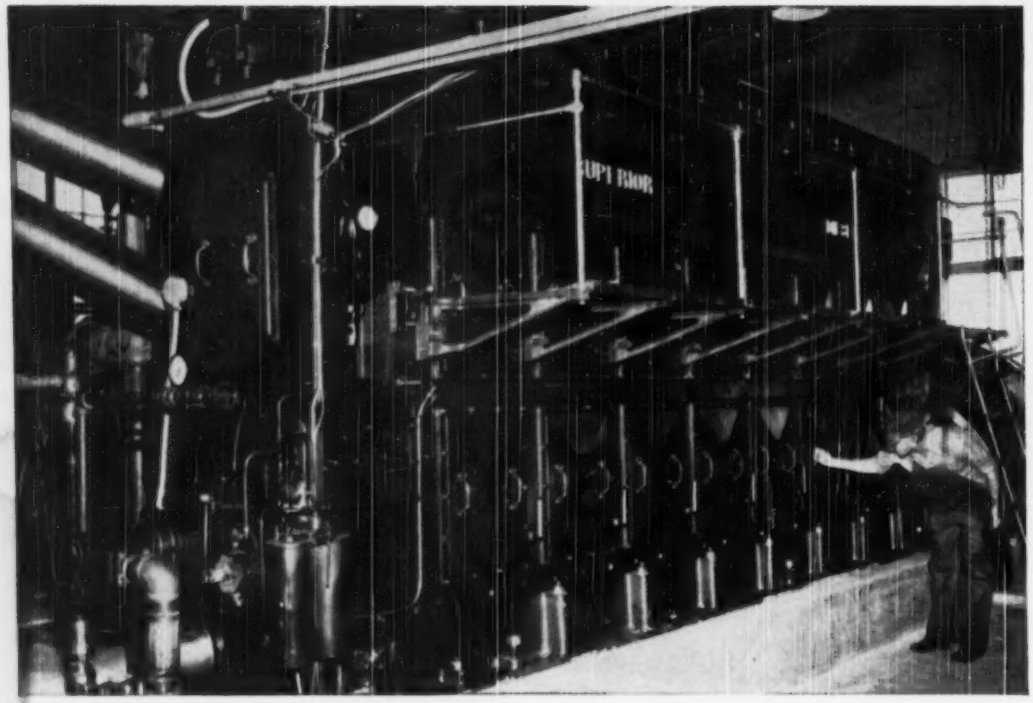
Please send me a free copy of your Bulletin LS-17, describing CORNING brand Lens Panels and PYREX brand Lenslites.

Name_____

Firm_____

Address_____

City_____ Zone_____ State_____



How Superior's Dual Fuel Feature Saved $10,000 in Six Months

Superior's Dual Fuel feature has opened the door to lower power costs in many installations. Recently one of our customers told us that by operating on gas, a Model 80 Dual Fuel Superior saved approximately $10,000 in fuel in six months. What's more, maintenance costs are staying at a low level even when gas is used.

As a result of these substantial savings, this Superior owner ordered another Model 80 Superior Diesel. This engine is also capable of developing 1440 HP with 1000 KW capacity at 360 RPM on *either* oil or gas.

It's easy to switch from oil to gas or from gas to oil with a Superior. It can be done instantly . . . with a flick of a finger . . . all the operator has to do is push a button.

Our representative can give you all the operating details on this and other successful Superior installations. Chances are he can help you accomplish the same results. Just write and tell us when he should call or, if you prefer, send for our fully illustrated booklet.

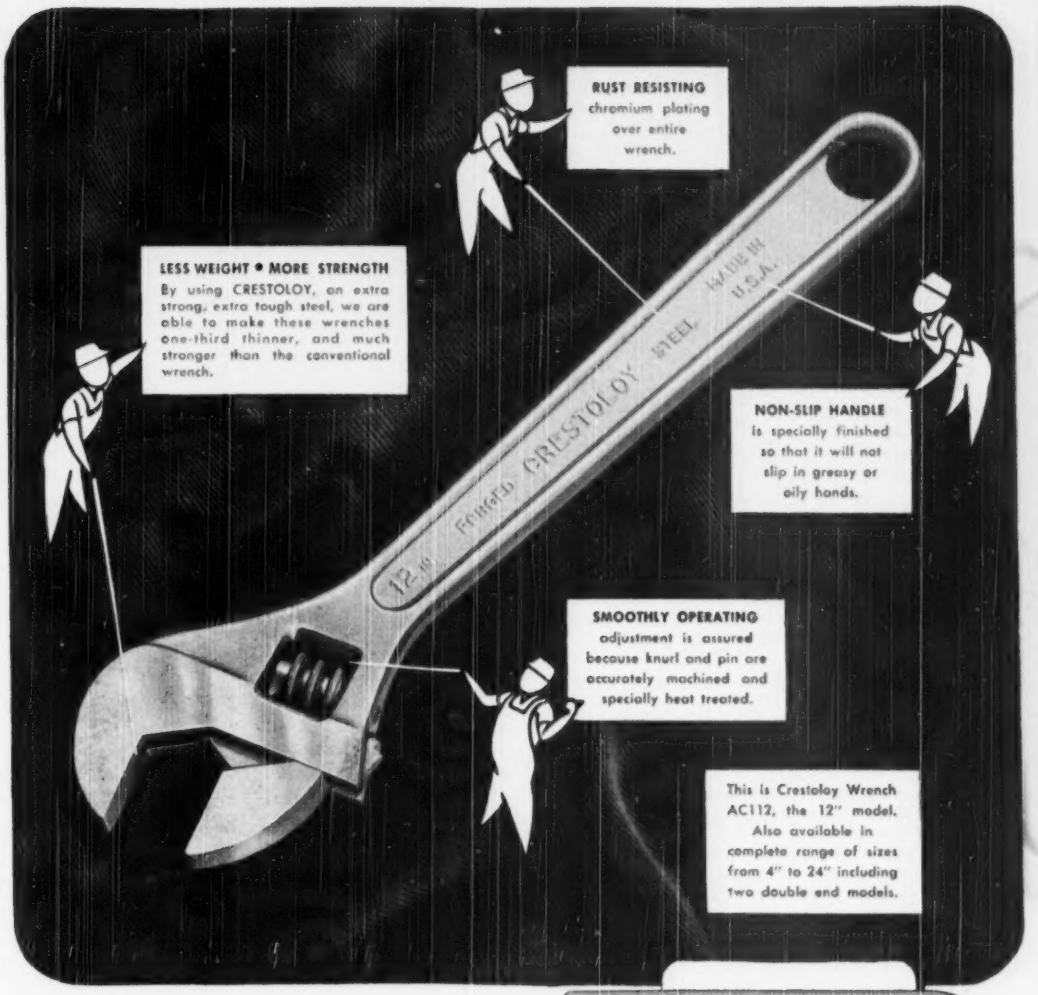
THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESELS

Locomotive • Marine • Oil Field • Stationary

CRAFTSMEN RECOGNIZE QUALITY *by these fine features in* ADJUSTABLE WRENCHES


RUST RESISTING
chromium plating over entire wrench.
LESS WEIGHT • MORE STRENGTH
By using CRESTOLOY, an extra strong, extra tough steel, we are able to make these wrenches one-third thinner, and much stronger than the conventional wrench.
NON-SLIP HANDLE
is specially finished so that it will not slip in greasy or oily hands.
SMOOTHLY OPERATING
adjustment is assured because knurl and pin are accurately machined and specially heat treated.
This is Crestoloy Wrench AC112, the 12" model.
Also available in complete range of sizes from 4" to 24" including two double end models.
12"
FORGED CRESTOLOY STEEL
MADE IN U.S.A.

EVERYBODY RECOGNIZES QUALITY *by this Trade-mark*

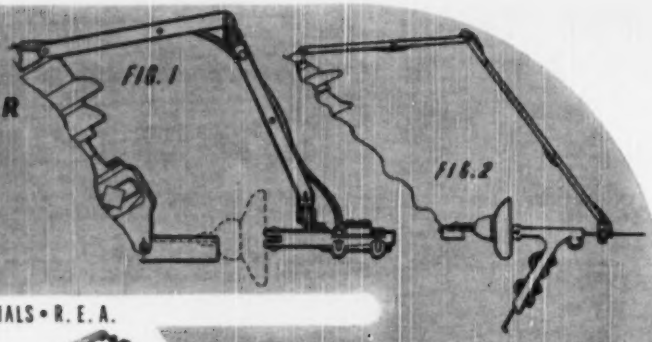
CRESCENT TOOLS

Sign of the Artisan
Symbol of Excellence

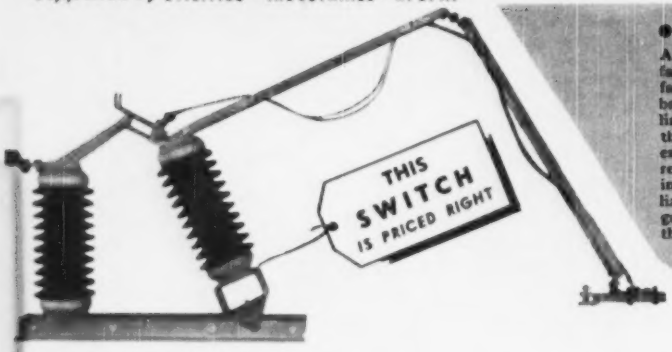
"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

ROYAL'S TILTING INSULATOR SWITCH TYPE AL-2



Approved by UTILITIES • INDUSTRIALS • R. E. A.



• EASY, SAFE INSTALLATION

A popular feature with installers is the fact that this switch incorporates in one factory-built unit the dead-end clamp, braid connection, pantograph support, and line connection (fig. 1). Once dead-ended the job is done, for no additional dead-ends are needed as in fig. 2. This has a real engineering advantage too — it eliminates the likelihood of conductor crystallization at the "hard spot" where pantograph and braid jumper are supported on the conductor outside the clamp.

• SELF-CLEANING CONTACTS

Multiple-finger, individually self-aligning, high-pressure point contacts of an exclusive design. In closing, the fingers engage the narrow axis of an elliptical cam. As the switch moves into operating position the fingers are spread to the wide axis of the cam, wiping the contact and strongly gripping the cam.

• CONSTRUCTION DETAILS

Standard Nema 3-in. bolt-circle insulators eliminate off-size insulators in your system. Braid jumpers are tinned copper, supported by a galvanized steel pantograph. Current carrying parts are of high conductivity, non-ferrous material. The steel tilting carriage will accommodate either a square steel or a full-size 2x4" wood interphase shaft. There is a silver-to-silver connection at the hinge end of the braid. The tilting insulator stops firmly and positively in both open and closed positions. There are no adjusting stops to position in the field.

• USEFUL AT CORNERS

The pantograph can be adjusted to swing for any angle up to 45°, thus saving the extra pole otherwise needed to straighten out the line when the conductor comes in at an angle. It is self-adjusting — loosen up the pantograph top screw, fit the switch in the closed position, then tighten it up.

. . . . . A LOW COST WELL ENGINEERED SWITCH WITH PLENTY OF EXTRA *Service Features*

TYPE AL-2 is of husky design so that it affords economy and dependability in substation service as well as for pole-top switching. It is packed with outstanding features that combine to give this switch a top rating.

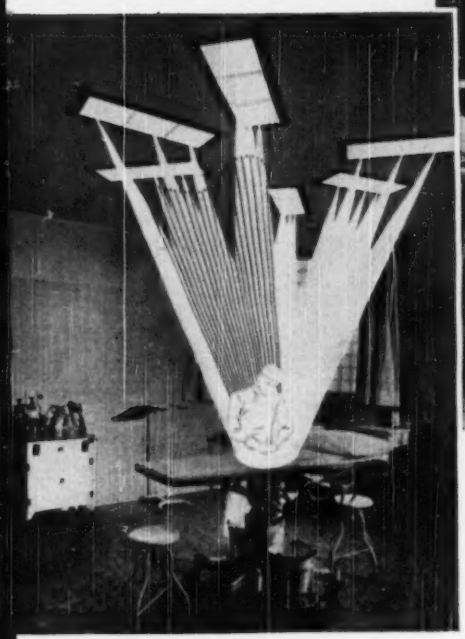
We suggest that you see pages 147, 148, 163 and 164 of our Catalog No. 11 where TYPE AL-2 is featured—then get in touch with us for any details you may want regarding this switch. It is built in voltages up to 46 k. v. and current ratings to 1200 amp.

★

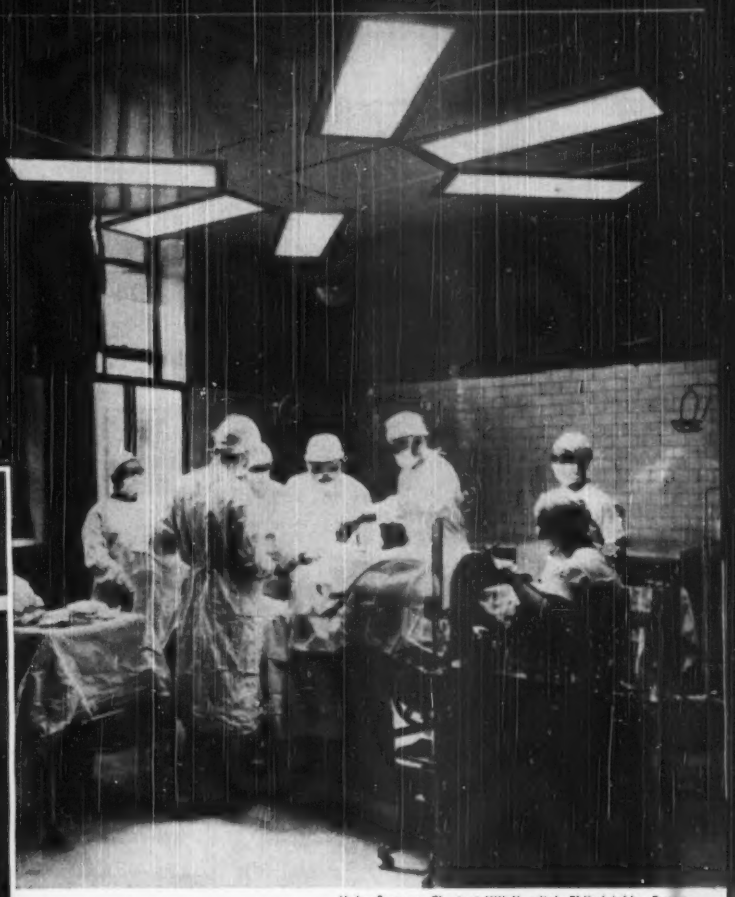
35 YEARS
A Part of the Arsenal of
AMERICAN POWER PRODUCTION

Royal ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET *Chicago 19, Ill.*
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

The NEW HOLOPHANE SURGERY LIGHTING SYSTEM Provides Most Effective, Economical, Dependable Illumination



Wide distribution of light sources insures rays that approach the wound area from many different directions, free from normal interception by personnel about the table.

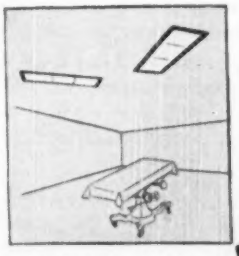


Major Surgery, Chestnut Hill Hospital, Philadelphia, Penna.

Eighteen Beams Concentrate Glareless, Shadowless, Comfortable Light on the Operating Area...

The Holophane Major Surgery Lighting System consists of 6 triple CONTROLENS* units with eighteen light beams which converge to provide (1) a high intensity spot on the operating area (2) a wider area of gradually diminishing light over the entire table (3) correct degree of balanced general illumination throughout the surgery . . . The light on the operating table is without glare, interfering shadows or objectionable heat . . . Location of the lighting system remote from the anaesthetization zone eliminates hazards of explosion; multiple lamping minimizes danger of interruption from lamp burnouts . . . The system is economical to maintain, easy to keep clean. Built-in ceiling arrangement gives the entire room a neater, more modern appearance.

Sketch showing Holophane Emergency or Minor Surgery System



Sketch showing Holophane Delivery Room System

Write for Latest Holophane Book . . . "Guide to Hospital Lighting" . . . Available without charge.

HOLOPHANE COMPANY, INC. Dept. E
342 Madison Avenue, New York 17, N. Y.

Please send your "Guide to Hospital Lighting" without charge

Individual_____

Organization_____

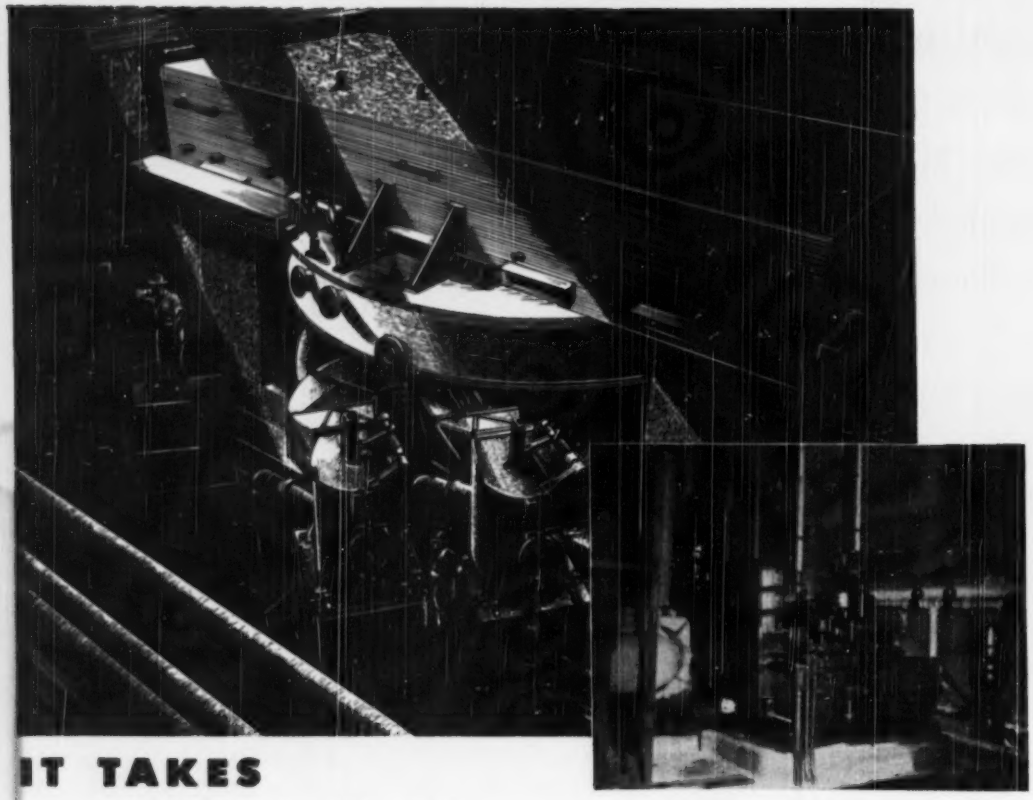
Address_____

*REG. U.S. PAT. OFF.

Holophane

HOLOPHANE COMPANY, INC.

Lighting Authorities Since 1890 · 342 MADISON AVENUE, NEW YORK 17, N. Y.



IT TAKES

DRY OIL

TO COOL AN ATOM-SMASHER!

Columbia University's giant Cyclotron generates tremendous heat when it smashes an atom. To dissipate this heat, 9,000 gallons of insulating oil are used. A De Laval Oil Purifier insures that the cooling oil is maintained dry and clean. Every drop was centrifuged as it first entered the Cyclotron's reservoir; when the Cyclotron is in operation, the oil is continuously purified by centrifugal force.

For nearly 30 years America's largest power companies have relied on De Laval centrifugal force for the purification of insulating oil. De Laval machines restore the high dielectric value of the oil at a single pass and at low temperature. Water once removed from the oil runs to waste and hence cannot recontaminate the oil.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

INSULATING OIL PURIFIERS

first again APPLETON

Vented Explosion-Proof Fixtures

PAT. APPLIED FOR

Lighting fixtures that breathe . . .

Here are explosion-proof lighting fixtures that weigh thirty percent less than fixtures of similar performance rating, yet diffuse ten percent more light while operating at substantially reduced temperatures.

This improvement in performance and efficiency is achieved by the use in manufacture of porous metal cylinders —a method of construction that equalizes both temperature and pressure, *literally allowing the fixture to breathe.*

Appleton Vented Lighting Fixtures are another Appleton "first"—products of the same engineering skill that gave industry its first explosion-proof fluorescent fixture. Whatever your illumination or electrical fitting requirements, specify Appleton—pace-setting manufacturer of electrical equipment for nearly half a century.

SOLD THROUGH ELECTRICAL WHOLESALERS

APPLETON ELECTRIC COMPANY

1703 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Avenue • ATLANTA, 724 Boulevard, N.E. • BIRMINGHAM, 429 Brown-Marx Bldg. • MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg • BALTIMORE, 100 East Pleasant St. • BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street • CINCINNATI, 626 Broadway • HOUSTON, 738 M. & M. Bldg

Resident Representatives:
Dallas, Indianapolis, Jacksonville, Kansas City, Milwaukee, Seattle

Export Representatives:
International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

SECTIONAL CONSTRUCTION

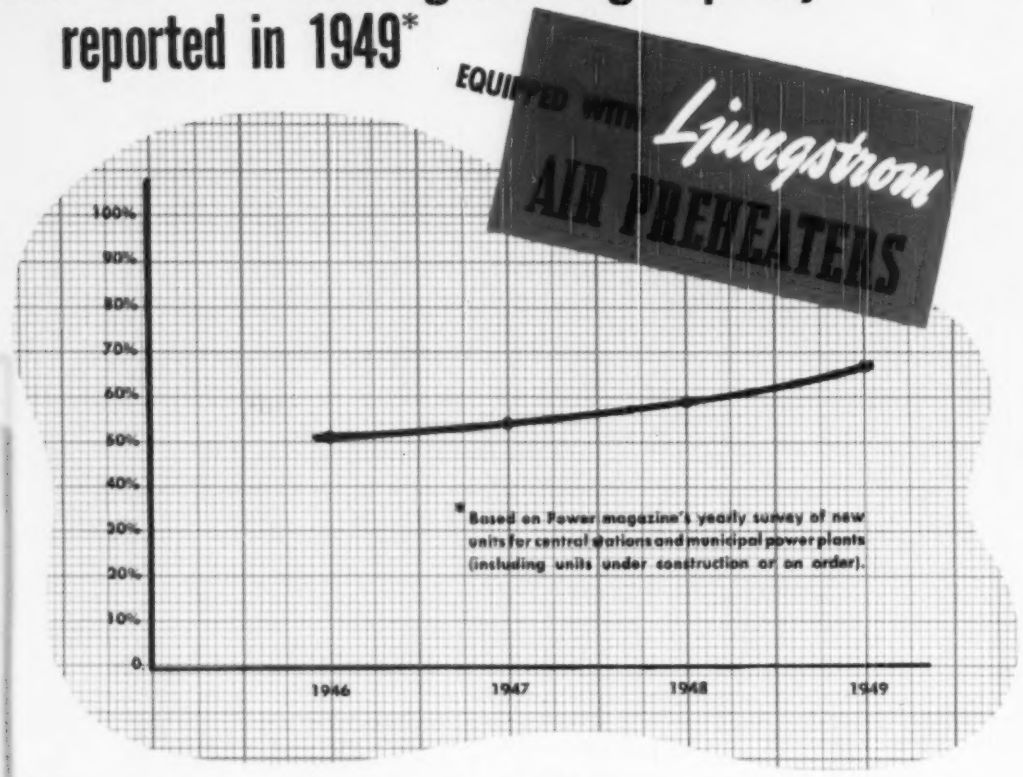
Connection block provided in canopy for line connections. No other connections are necessary.
Shock-absorbing socket.
Metal cylinder threads onto canopy, completely enclosing connection block.
Dome unit complete with large porex cylinder.
Heat-resisting glass globe is clamped in place and detaches itself from fixture when lower ring is removed.
Gaskets —
One Asbestos
One Aluminum.
Reflector held with three screws. Can be removed without dismantling fixture.
Guard secured with fastening screws to lower clamping ring.

APPLETON ELECTRIC PRODUCTS

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Over 65% of steam generating capacity reported in 1949*



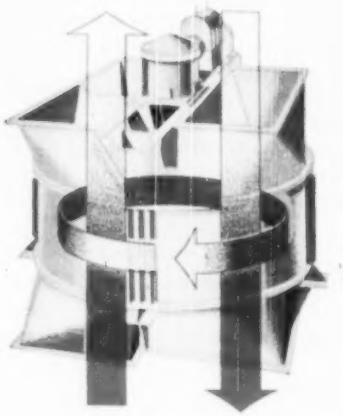
Again in 1949 utilities continued to register an increasing preference for the Ljungstrom regenerative air preheaters. Over 65% of the steam generating capacity for central stations and municipal power plants (including units under construction or on order) reported in Power magazine's 1949 Modern Plant Survey will be equipped with Ljungstrom air preheaters.

The reasons behind this wide acceptance of the Ljungstrom, the only regenerative type air preheater, are sound and simple:

1. High Heat Recovery: The Ljungstrom air preheater, by employing the continuous regenerative counterflow principle, assures the highest practical heat recovery, up to 70% of the total heat in the stack gases.

2. Low Operating Costs: The regenerative principle provides accurate control of metal temperature throughout the entire unit. This permits operation with low maintenance costs, under conditions which would cause rapid deterioration in other designs.

3. Reliability: The high availability of the Ljungstrom air preheaters with all types of boilers, under every condition of operation, is a matter of record in power plants throughout the country.



The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 EAST 42d STREET • NEW YORK 17, NEW YORK

Cables run COOLER...
in TRANSITE DUCTS

. . . reducing copper losses

. . . increasing current capacity

. . . prolonging insulation life

HERE'S HOW to reduce copper losses . . . increase current carrying capacity . . . and prolong insulation life—run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

JM

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%

Earth Temp. ambient—20 C	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric Loss (C)	1.9	2.1
Allowable Rise for Copper Loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	100.

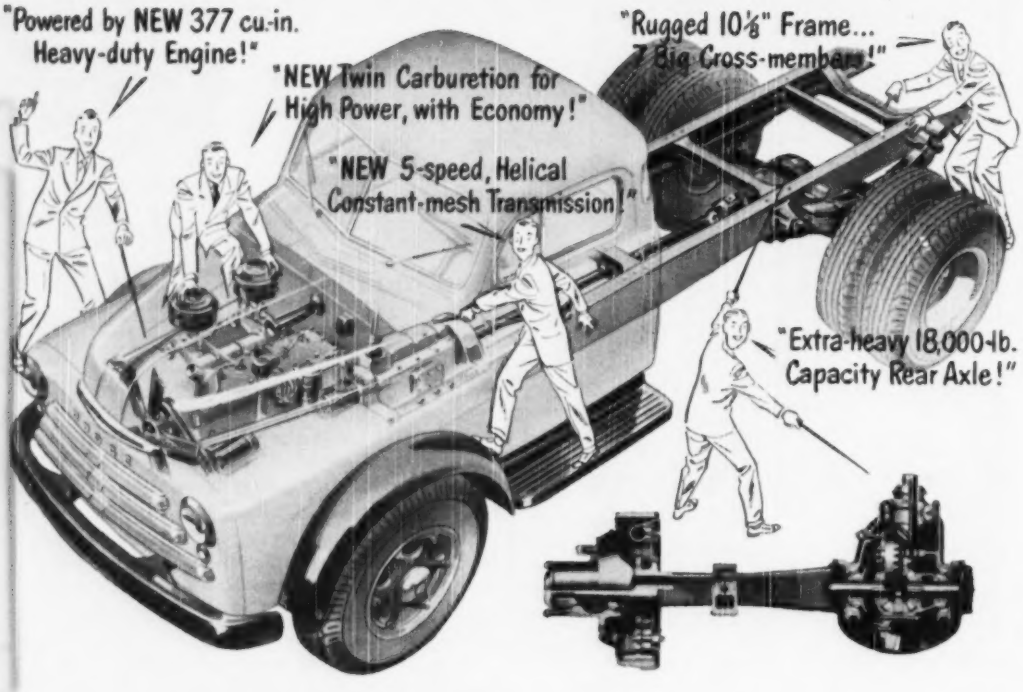
Johns-Manville *Transite Ducts* "KORDUCT"—for encasement in concrete

"CONDUIT"—for use exposed and underground without encasement

BIG NEWS for haulers of BIG LOADS!

New Heavy-Duty 4-TON

DODGE "Job-Rated" TRUCKS


"Powered by NEW 377 cu.in. Heavy-duty Engine!"
"NEW Twin Carburetion for High Power, with Economy!"
"NEW 5-speed, Helical Constant-mesh Transmission!"
"Rugged 10⅛" Frame... 7 Big Cross-members!"
"Extra-heavy 18,000-lb. Capacity Rear Axle!"

There's a new champion in the HEAVY-DUTY truck field. It's the new Dodge truck rated at 28,000 pounds G.V.W. . . . 50,000 pounds G.C.W.!

Ample "*Job-Rated*" POWER flows from one of the finest-performing, and most economical truck engines ever designed. It develops 154 gross horsepower, and 330 pound-feet gross torque.

This remarkable engine contains such advanced long-life features as Silchrome intake valves and inserts. Exhaust valves are Stellite-faced and sodium-filled to resist warping, wear longer.

Hydraulic lifters insure perfect valve operation. Rustproof water distributor tube provides maximum valve seat cooling, and lengthens engine life. High power output and economy result from two downdraft carburetors. Features are numerous: Dual intake manifold; dual exhaust system; high anti-vapor-lock pump; ceramic fuel filters; velocity-type governors; oil-bath air cleaners, and many others.

This "*Job-Rated*" load lugger has a new and rugged constant-mesh, 5-speed helical transmission, direct-in-fifth, with an extremely high torque input. A 5-speed overdrive transmission is available.

This 4-tonner has a rugged 10⅛-inch frame, with 7 and 8 big crossmembers; extra-heavy 18,000- and 22,000-pound capacity rear axles, and many other HEAVY-DUTY features you'll want to study and compare.

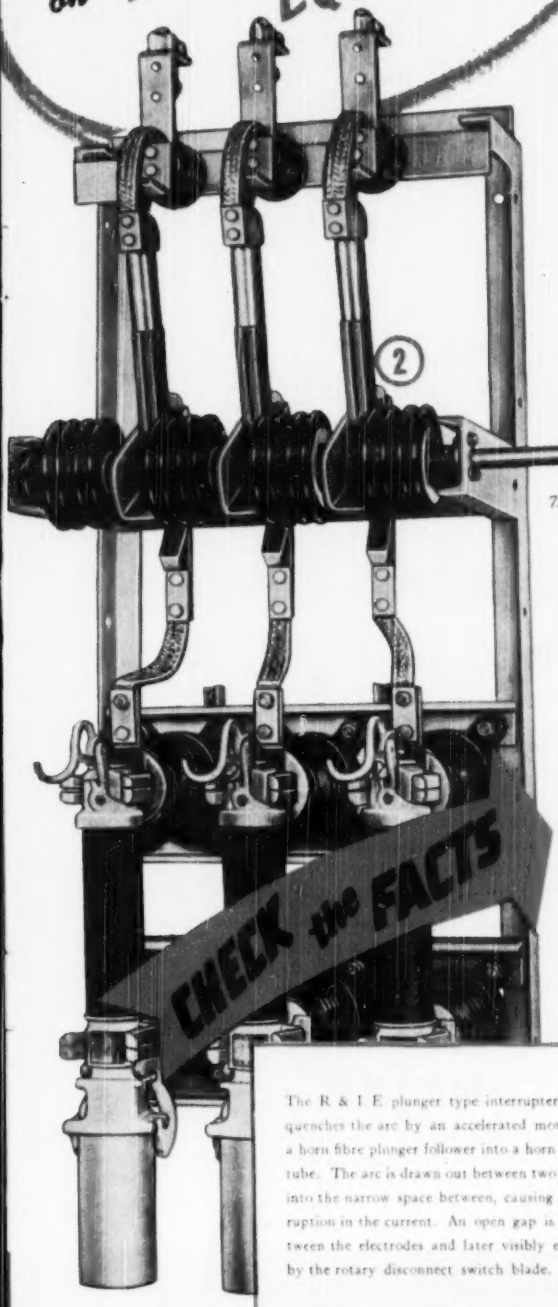
If your transportation requirements fall in the 28,000-pound G.V.W. range (up to 50,000 pounds G.C.W.), we believe you'll find this 4-ton heavyweight your long-awaited answer to . . . *lower cost hauling!*

See your Dodge dealer at your earliest convenience.

For low-cost transportation...switch to

DODGE "Job-Rated" TRUCKS

Save Money and Worry on FAULT PROTECTION EQUIPMENT

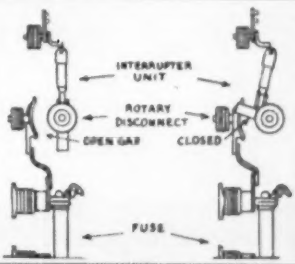


75 KV, 400 Ampere Fuses shown.

Install R&IE INTERRUPTER SWITCHES at LOAD CENTERS

1. Compact, easy to install, mounts anywhere—wall, transformer throat, etc.
2. Reliable load interrupter and open gap switch assembly, single or double throw.
3. Operating handle equipped with sequencing device to prevent opening of switch before it is fully closed. This guarantees proper interrupting operation.
4. Provision for Kirk Key Interlock or Solenoid type system.
5. Any fuse combination—below interrupter as shown, or above, if required.
6. Housing can be furnished. Key or mechanical door interlocks optional.

The R & I E plunger type interrupter chamber quenches the arc by an accelerated movement of a horn fibre plunger follower into a horn fibre lined tube. The arc is drawn out between two electrodes into the narrow space between, causing the interruption in the current. An open gap is made between the electrodes and later visibly established by the rotary disconnect switch blade.



RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA — EASTERN POWER DEVICES LIMITED, TORONTO

I-T-E R&IE

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY-DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

"Courteous treatment by salesmen" . . . that's only one of the things we mean by Service Plus!

BARS · PLATES
STRUCTURALS · SHEETS
STRIP · REINFORCING BARS
* * *
STAINLESS
ALLOY STEELS
ALUMINUM
* * *
TOOLS · EQUIPMENT
MACHINERY

● A recent survey of our customers impressed us again with the fact that "a company is only as good as its personnel!" Many customers told us that they like to do business with United States Steel Supply Company because of the courteous attention they receive from our salesmen. We're glad their efforts are appreciated and we assure you that every order you place, large or small, will receive prompt, courteous attention from men who know their business.

Service Plus is our pledge to handle your order as you want it handled. Our capacity to serve you includes a complete range of steel products, an unrivaled reputation for prompt delivery, and years of experience in providing the most complete steel service available.

WHEN YOU DEAL WITH US, YOU GET Service Plus!

UNITED STATES STEEL SUPPLY COMPANY

Warehouses: BALTIMORE · BOSTON · CHICAGO
CLEVELAND · LOS ANGELES · MILWAUKEE · MOLINE, ILL. · NEWARK · PITTSBURGH
PORTLAND, ORE. · SAN FRANCISCO · SEATTLE · ST. LOUIS · TWIN CITY (ST. PAUL)
Also Sales Offices at: KANSAS CITY, MO. · PHILADELPHIA · TOLEDO · TULSA · YOUNGSTOWN
Headquarters Offices: 208 S. La Salle St.—Chicago 4, Ill.

UNITED STATES STEEL

Before you invest in lighting make sure of its overall cost

New Miller "DUST TIGHT and VAPOR TIGHT" luminaires have broad application in industrial areas where inflammable dusts are present in the atmosphere and in non-hazardous locations where luminaire components must be protected from non-combustible vapor and dusts.

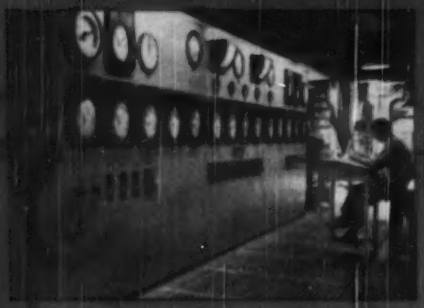
OVERALL cost is equipment cost, *plus* cost of installation and maintenance. Built into all Miller lighting equipment are construction features that simplify installation and maintenance, and make for LOW OVERALL COST. When you add to this, fine illumination performance and pleasing appearance, you have the reason why Miller lighting equipment is your best investment in lighting. It is built on our 8-Point Standard of Quality Construction, and strict adherence to our 106-year tradition of pioneering in GOOD LIGHTING AT LOW OVERALL COST. Whatever your lighting requirements, you can light with confidence the proven Miller way. Miller field engineers and distributors are conveniently located. Write for "DUST TIGHT and VAPOR TIGHT" Catalog.

"Painting Toward Architecture" — a book about The Miller Company's collection of abstract paintings related to Architecture. Available at leading book stores.

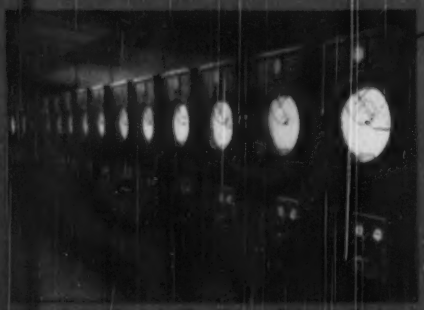
THE miller COMPANY
SINCE 1844
ILLUMINATING DIVISION, MERIDEN, CONNECTICUT

ILLUMINATING DIVISION Fluorescent, Incandescent, Mercury Lighting Equipment. HEATING PRODUCTS DIVISION Domestic Oil Burners and Liquid Fuel Devices. ROLLING MILL DIVISION Phosphor Bronze and Brass in Sheets, Strips and Rolls

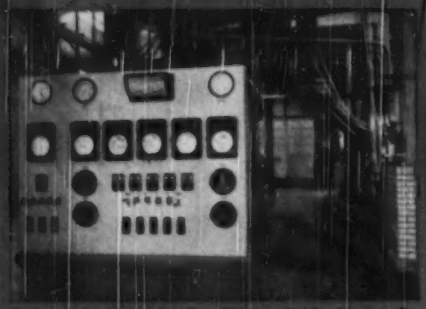
Bailey Boiler Control—Gas or Oil Firing—Pacific Gas & Electric Co., Avon Station.



Bailey Boiler Control—Oil Firing—American Potash and Chemical Corp., Trona, Calif.



Bailey Boiler Control—Gas Firing—Colorado Fuel and Iron Corp., Pueblo, Colo.



Bailey Boiler Control—Gas Firing—Public Service Co. of New Mexico, Albuquerque, N. M.

More Power per fuel dollar—that's the basic business of Bailey Meter Company. Our products and services are designed to deliver increased power plant efficiency for you, whether your plant is large or small. We have had a wealth of experience on every size and type of steam generating equipment.

Here are some of the reasons why we believe we have more to offer you in this field than any other single manufacturer:

More Complete Range of Equipment

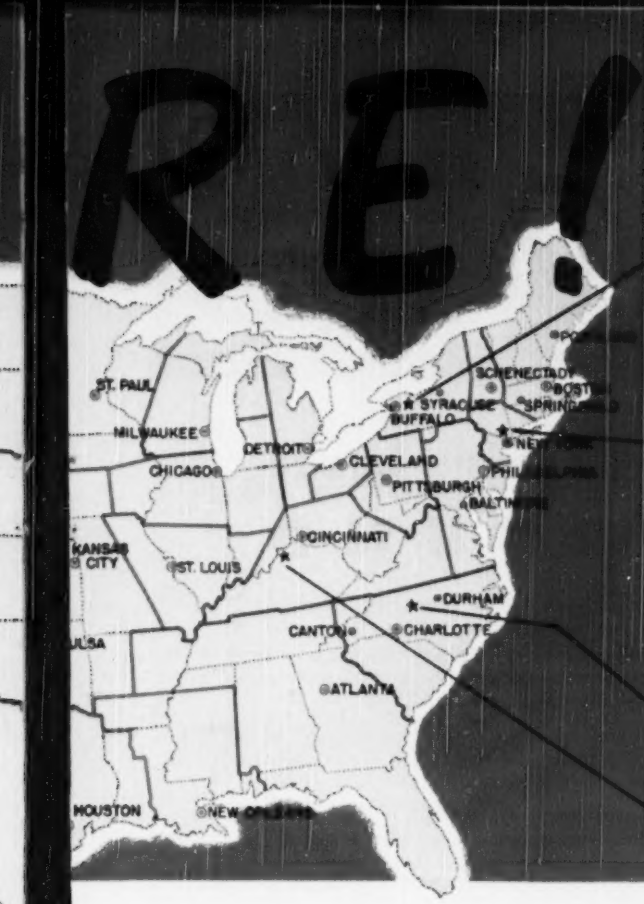
Our fully co-ordinated line of Meters and Controls is offered for a wide variety of services and in a complete range of types. This means you need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment merely because he is unable to offer the exact one best suited to your needs. It means, too, that you need never fear a buck-passing division of responsibility for the efficient operation of your complete boiler control system.

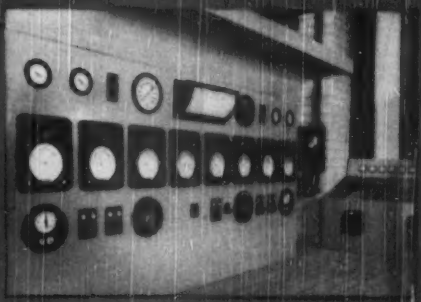
More Experienced Engineering Service

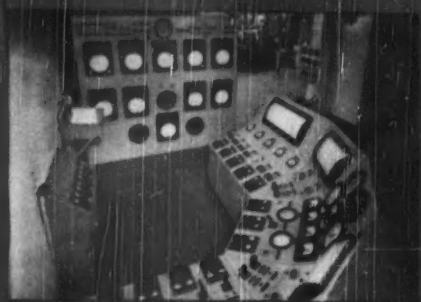
When you discuss your power plant problems with a Bailey Sales-Service

Giving More Power to You...

CONTROLS for—Combustion • Feed Water • Temperature • Pressure • Liquid Level • Feed Pumps







Engineer, you get advice from an organization with a background of more knowledge and experience in steam plant operation than any other manufacturer of instruments and controls can offer you. Our field representatives are graduate engineers with specialized training in combustion, flow measurement and automatic control. Each has completed an intensive course in theory and practice at our plant before being given a field sales-service assignment.

More Direct Sales-Service Offices

Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems. Truly, prompt and capable service—and with a minimum of travel time and expense—is as near as your telephone. In emergencies a trained Bailey Engineer is available in a matter of minutes or a few hours at the most.

Giving More Power to You

Better power plant operation calls for more power per fuel dollar, less outage, and safer working conditions. We help you to get all of these. Write for Bulletin 15G describing Bailey Meters and Control Systems.

Bailey Meter Company

1060 Ivanhoe Road, Cleveland 10, Ohio • Bailey Meter Company Limited, Montreal, Canada

B-30

ORANGEBURG
FIBRE CONDUIT

STANDARD
Installed with Concrete
NOCRETE
Installed without Concrete

Cables "Walled In" For Lifetime Service
UNDERGROUND

The ELECTRICAL ENGINEER realizes that the push of a button floods the home with light or sends power pulsing into the industrial machine *only when all's well with the underground cables.* ORANGEBURG CONDUIT helps keep these *life-lines long-lived.*

The *impermeable* walls and tight taper sleeve joints of ORANGEBURG CONDUIT protect cables *permanently* from corrosion . . . just as its smoother bore and low coefficient friction safeguard it *from* Cable Sheath Abrasion, *from* Pulling Tensions, *with* Cable Movement . . . facts proved by ORANGEBURG'S 50-year record underground.

Above ground, the news is also good . . . because ORANGEBURG CONDUIT combines unique strength and toughness with light weight, ease of handling, transportation and installation. These features together with its permanent resistance to corrosive ground waters and chemical wastes, provide a product that is low in *initial* and *maintenance* cost.

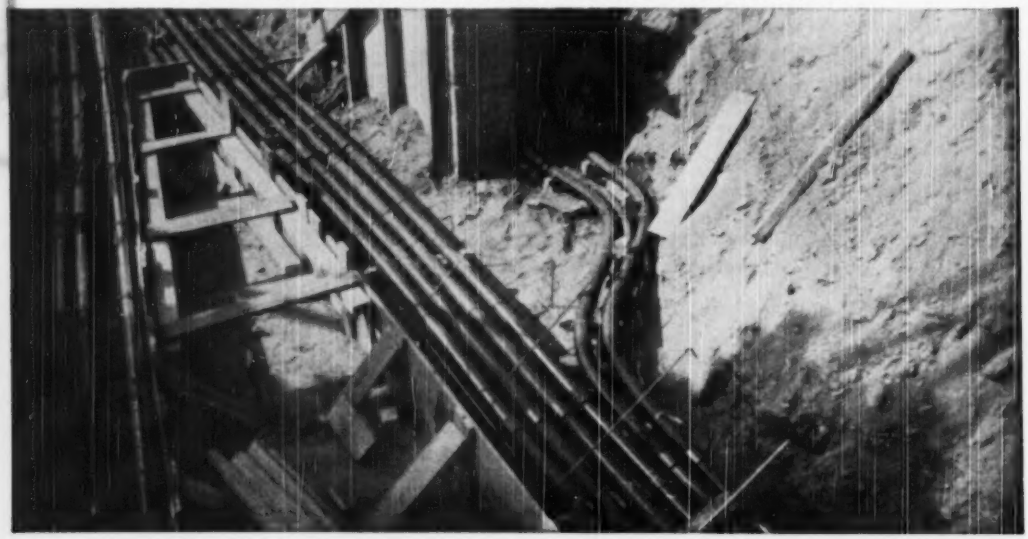
For more complete information write today for ORANGEBURG Catalog No. 50. Keep it for ready reference in your files.

ORANGEBURG STANDARD — For installation with concrete encasement. ORANGEBURG NOCRETE — For installation without concrete encasement.

Distributors · Graybar Electric Co., Inc.
General Electric Supply Corp.

Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

Illustration below is ORANGEBURG STANDARD *for installation with concrete encasement.*



the specialist does it better!

As proved by more than 1,000,000 Kvar in over 4,000 capacitor installations, for over a decade on utility systems throughout the world.

CORNELL-DUBILIER CAPACITORS

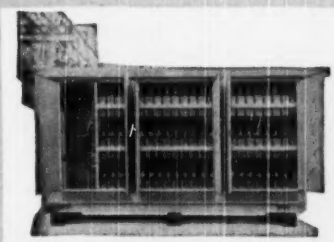
PRODUCTS OF SPECIALISTS IN POWER-FACTOR IMPROVEMENT

A national average of over a decade of trouble-free utility service proves conclusively that, in the *power-factor improvement field*, the specialist does it better. That the experience of these utilities will be your experience is not a mere paper promise, nor a laboratory hope. For C-D capacitors have stood the test of time in the field—the toughest test of all. For Consistently Dependable results in the field, specify C-D capacitors. Your inquiries are invited.

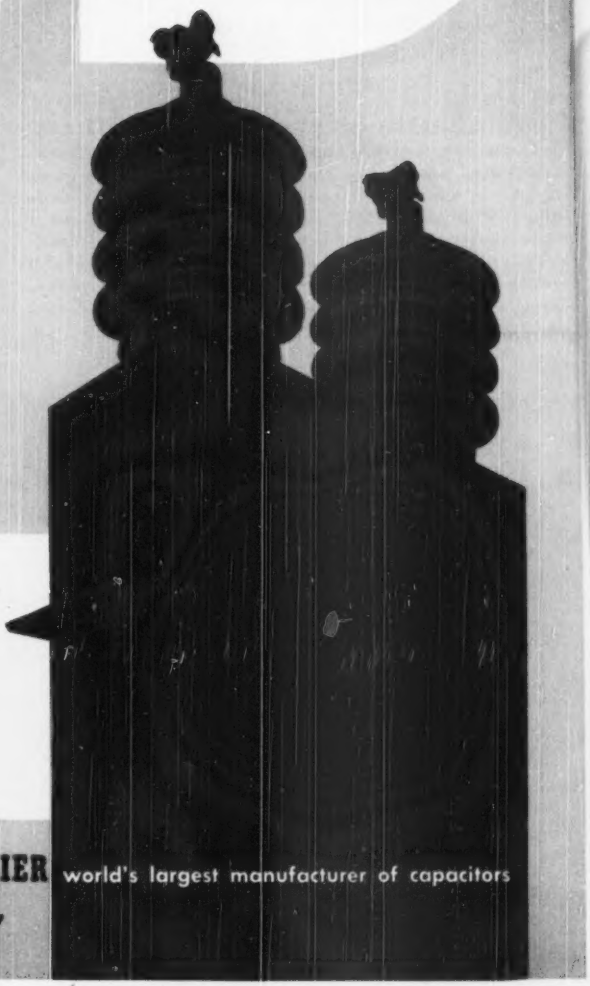
Cornell-Dubilier Electric Corporation, Dept. D 10, South Plainfield, New Jersey. Other plants in New Bedford, Worcester and Brookline, Mass.; Providence, R. I.; Indianapolis, Ind. and Cleveland, Ohio.

Follow the leaders

Demand dependable C-D Capacitors—built by capacitor specialists.



1,980 Kvar; 4,160 volt, WYE; 3 phase; 60 cycle; station-type C-D equipment.



CORNELL-DUBILIER world's largest manufacturer of capacitors

C-D Best by Field Test!

America's Most Outstanding Truck Values

—with more power than ever!

Here are the models to make motor-truck history. These new Chevrolet P-L trucks are advance-designed for the heaviest loads, the roughest roads, the lowest cost per trip.

They are far ahead in popularity, performance, payload, price—and they are the *most powerful trucks Chevrolet has ever built.* There is a P-L truck for every trucking job and every one is a real leader on the job.

Chevrolet Motor Division, General Motors Corporation
Detroit 2, Michigan

Leading with all these PLus *Features:*

• TWO GREAT VALVE-IN-HEAD ENGINES: the New 105-h.p. Load-Master and the improved 92-h.p. Thrift-Master—to give you greater power per gallon, lower cost per load • THE NEW POWER-JET CARBURETOR: smoother, quicker acceleration response • DIAPHRAGM SPRING CLUTCH for easy action engagement • SYNCHRO-MESH TRANSMISSIONS for fast, smooth shifting • HYPOID REAR AXLES—5 times more durable than spiral bevel type • DOUBLE-ARTICULATED BRAKES—for complete driver control • WIDE-BASE WHEELS for increased tire mileage • ADVANCE-DESIGN STYLING with the "Cab that Breathes" • BALL-TYPE STEERING for easier handling • UNIT-DESIGN BODIES—precision built.

CHEVROLET

P*•L*

ADVANCE-DESIGN TRUCKS

P*opularity L*eaders Official truck registration figures for 1949 show Chevrolet trucks preferred over the next two makes combined—proof of the owner satisfaction they earn through the years.

P*erformance L*eaders The new Chevrolet P-L trucks give you high pulling power over a wide range of usable road speeds—and on the straightaway, high acceleration to cut down total trip time.

P*ayload L*eaders The rugged construction and all-around economy of Chevrolet P-L trucks cut operating and repair costs—let you deliver the goods with real reductions in cost per ton per mile.

P*rice L*eaders The Chevrolet truck line is the very lowest priced line in the field—saves on initial cost. What's more P-L trucks give owners dollar and cents savings in maintenance and operation.

CHEVROLET

Over 1,000,000 NEW kw's from plants using KELLOGG power piping!

ONE million kilowatts of generating capacity require a whale of a lot of power piping. And when you reflect that this volume is confined solely to completed plants and not to piping supplied by Kellogg in the last 25 years, it takes on added significance.

But the actual volume is not so indicative as the reasons behind it. For example, most of these piping installations began on Kellogg's exclusive apparatus for determining stresses in piping layouts . . .

. . . Two called for unusual experience in welding, for they were the first 1050°F. installations employing stainless steel . . .

. . . Another required the fabrication of unique transition pieces in which two metals varying in thermal expansion by 50% were *Kelcaloyed* as single bi-metallic pieces with ends formed of different metals . . .

. . . On several of the jobs availability of experienced supervisors for welding and stress relieving on the site was the key requirement . . .

. . . And all of the installations reflected the results of extended study of such problems as graphitization, creep stress rupture that has been going on for years in Kellogg metallurgical laboratories.

Together these plants, eventually to provide more than one million kilowatts—and those of the past and future—indicate the extra value inherent in Kellogg's participation in the high temperature and pressure piping phase of power plant expansion and construction.

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

KELLOGG

Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

Vessels
Exchangers
Condensers
Process Piping
Forged and Welded Fittings
Radial Brick Chimneys

The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

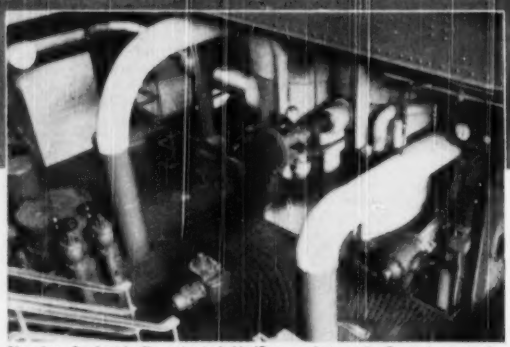
SEWAREN GENERATING STATION—*Uses..*

(Public Service Electric and Gas Company)

LIMITORQUE VALVE CONTROLS

—*because they're* DEPENDABLE,

Safe, Accurate and Trouble-Free

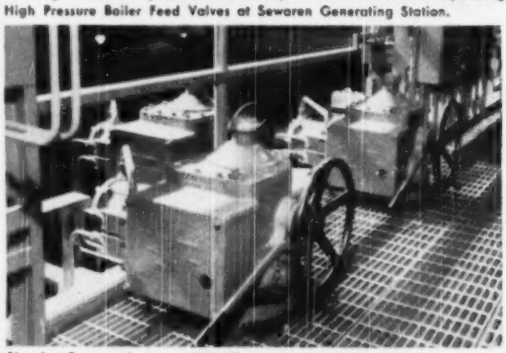


Showing 3 electrically actuated *LimiTorque* Automatic Controls operating High Pressure Boiler Feed Valves at Sewaren Generating Station.

We are very appreciative of the fact that this large, modern Central Station has (like many other modern stations throughout America) installed *LimiTorque Automatic Valve Operators* for their high pressure Boiler Feed Lines, and for sluice gate actuation.

LimiTorque Remote Control enables one man to merely "push buttons" and actually see on a panel-board whether the valves are open or closed. Then too, there is the important safety factor afforded by *LimiTorque Remote Control*, because men do not have to go to high, low, dangerous or inaccessible locations to open and close valves. Further, *LimiTorque* prevents damage to seats, discs, stems, etc., because it "automatically" shuts-off the power, should an obstruction in closing occur.

LimiTorques are available for different requirements on all types of valves (globe, gate, butterfly, plug, etc.) —and may be supplied for actuation by any power source, such as electricity, steam, water, gas, oil or air.



Showing 3 more air actuated *LimiTorque* Automatic Controls also operating High Pressure Boiler Feed Valves at Sewaren Generating Station.

Thousands of *LimiTorques* are in use throughout the world, on land and sea. Be convinced; send for our 96-page catalog, L-48, and please use your Business Letterhead when requesting same.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON

IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Uniformity

The days of "file and fit" went out when volume methods came in. The modern assembly line in large production plants is in itself so dramatically arresting a spectacle that the "feeder lines", of which there are hundreds in every volume industry, are lost sight of. Just as mighty rivers exist only because of the less majestic tributaries, so the production line is dependent upon sources of supply so unvarying in flow and quality, that every part is ready and right to "fall into place" with mechanical precision and constant supply. Our production line has been standardized to a degree of uniformity attainable only through long-time development of machines, controls and skilled workmen.

MACALLEN MICA

A product developed for big business through serving the needs and keeping the pace of big business. Obviously best to help small business grow bigger.

MACALLEN MICA

ALL FORMS, ALL QUANTITIES — ALL DEPENDABLE

when you think of MICA, think of MACALLEN

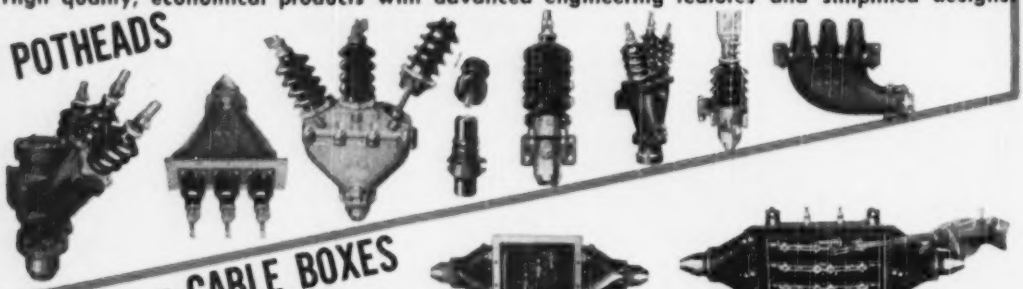
THE MACALLEN COMPANY 16 MACALLEN STREET • BOSTON 27, MASS.
CHICAGO: 565 W. WASHINGTON BLVD. • CLEVELAND: 1231 SUPERIOR AVE.

1905 — 45 YEARS OF SERVICE — 1950

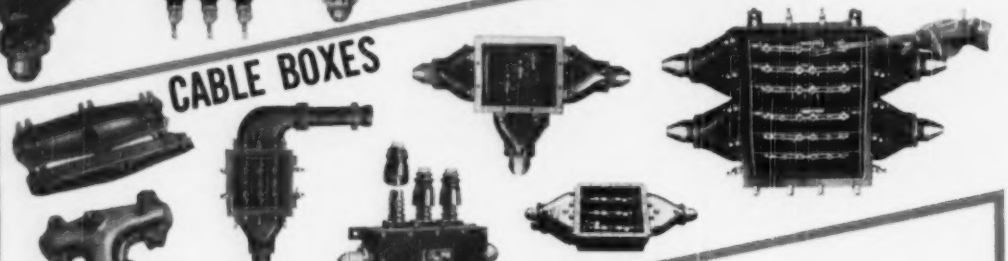
Specify **G & W** *cable devices*

High quality, economical products with advanced engineering features and simplified designs

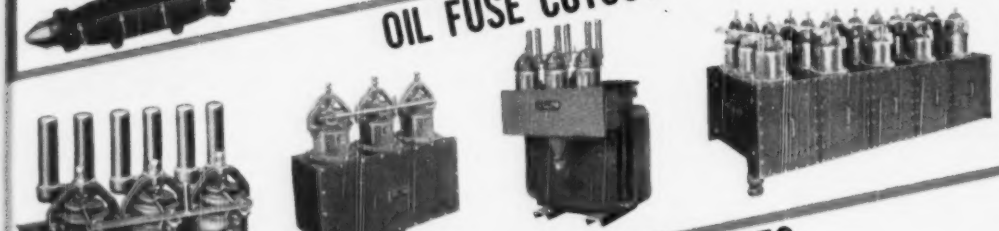
POTHEADS



CABLE BOXES

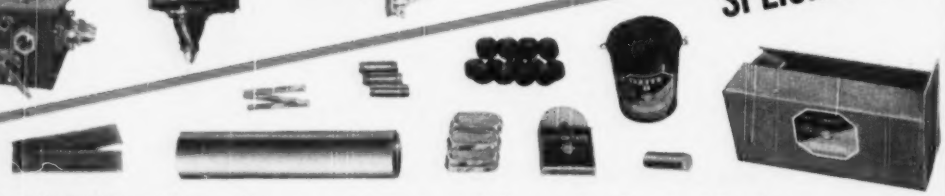


OIL FUSE CUTOUTS



OIL SWITCHES

SPLICING KITS

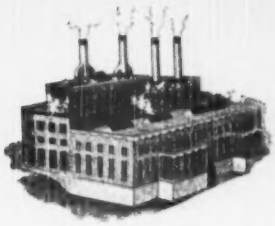


For detailed information write us or our representatives — there's no obligation.

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVENUE, CHICAGO 19, ILLINOIS, U. S. A.

Representatives in principal cities in U. S. A. **In Canada; Powerlite Devices, Ltd., Toronto**

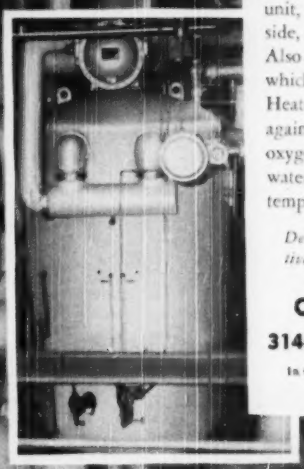
COCHRANE DEAERATORS AT CLIFFSIDE



The final unit of the Cliffside Station of the Duke Power Company brought the total output of this great generating station to 210,000 KW. Contributing to the efficient operation of this unit, as they have to the earlier units at Cliffside, are the Cochrane Deaerators listed below. Also listed are the other Duke Power stations which have installed Cochrane Deaerators and Heaters to protect boilers, piping and turbines against rust and corrosion by removing excess oxygen and other corrosive gases from the feedwater and by heating the feedwater to steam temperature.

Details of any of these installations or descriptive bulletin may be obtained by writing

COCHRANE CORPORATION
3146 N. 17th St. • Philadelphia 32, Pa.
In Canada: Canadian General Electric Company, Ltd., Toronto



DUKE STATIONS equipped with COCHRANE DEAERATORS and Feedwater Heaters

CLIFFSIDE
Two 375,000 lb/hr Deaerators
Two 600,000 lb/hr Deaerators
Two 8,000 lb/hr Open Heaters

BUCK
One 725,000 lb/hr Deaerator
Two 500,000 lb/hr Deaerators

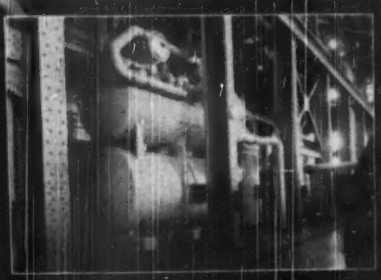
TIGER
One 540,000 lb/hr Open Heater

MOUNT HOLLY
Two 270,000 lb/hr Open Heaters

ENO
One 270,000 lb/hr Open Heater

DAN RIVER
Two 650,000 lb/hr Deaerators

COCHRANE CORPORATION 87 YEARS OF SERVICE 1863 • 1950



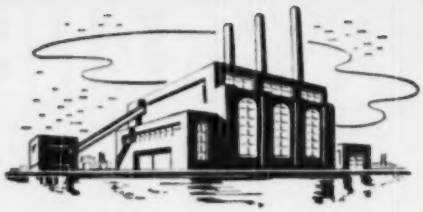
COCHRANE

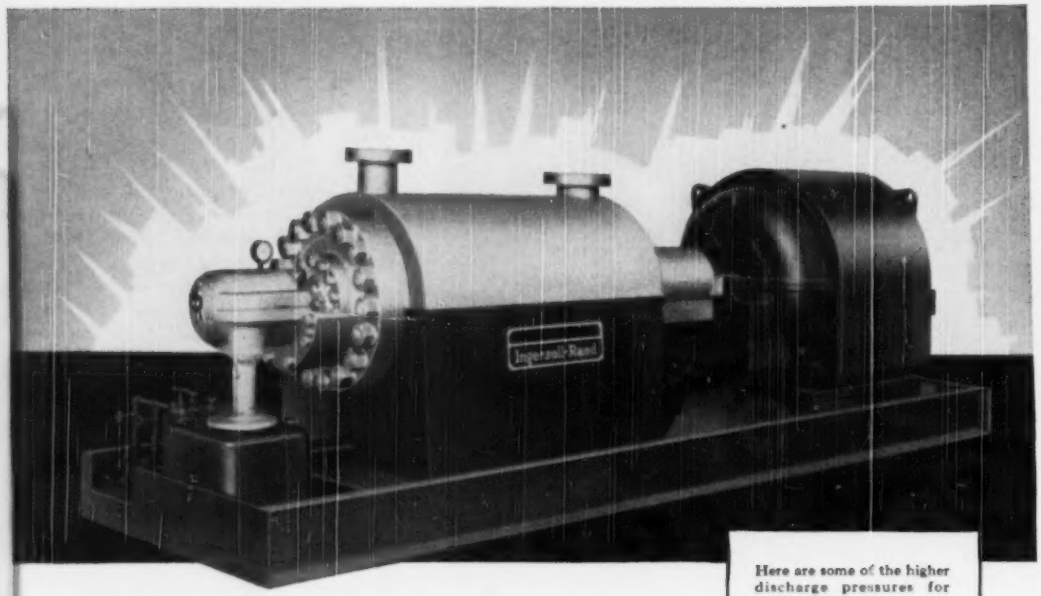
SOFTENERS • FILTERS • DEAERATORS • CONTINUOUS BLOW-OFF SYSTEMS

Here's one way to measure the

DEPENDABILITY

of Ingersoll-Rand Boiler-Feed Pumps





The overwhelming acceptance of I-R Boiler-Feed Pumps for high-pressure service speaks for itself

DEPENDABILITY is probably the most important single requirement in modern central station equipment. And that's why I-R double-case pumps are first choice for really high-pressure boiler-feed service. Their ability to pump feed water at discharge pressures as high as 2900 psi has been thoroughly proven by long, trouble-free service in many outstanding high-pressure installations. And over 40% of the I-R double-case pumps sold are on repeat orders—from users who have proved this dependability in their own plants.

Whatever the pressure, or the capacity, Ingersoll-Rand can supply the right boiler-feed pump constructed of the proper materials. Call your I-R branch office the next time you have a pumping problem.

Here are some of the higher discharge pressures for which utility companies have purchased I-R double-case pumps. Some of these pumps have been in service for as long as 12 years.

Pump Discharge Pressure PSIG	
2900	1850
2470	1845
2395	1800
2180	1795
1990	1750
1895	1745
1890	1725
1870	1700

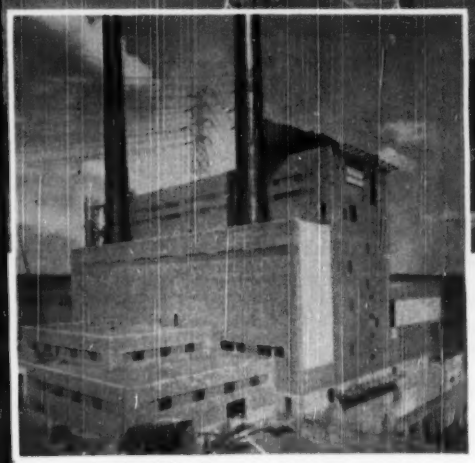
Ingersoll-Rand

Cameron Pump Division 390-10

11 Broadway, New York 4, N. Y.

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL AND GAS ENGINES

A new "high" in tower dependability and economy



American Bridge Company fabricated and erected the structural steelwork for the new Philip Sporn Plant, which utilizes four of the largest steam generators in the country.

These 240-ft. river crossing towers are among the highest in use. They're double circuit, 132 kv towers carrying six 477,000 CM, ACSR conductors and one 159,000 CM, ACSR ground wire.

"Streamlined" towers handle heavy duty job for A. G. E. System

THE tall, double-circuit towers shown above are among the approximately 160 erected to join the new 550,000-kw Philip Sporn Plant at Graham Station, W. Va., to the 132 kv transmission network of the American Gas and Electric System.

Designed and fabricated by American Bridge Company, these steel towers stand as proof of the soundness of "streamlined" towers—stripped of all non-essentials—for even the heaviest duty. Equipped with steel grillage earth anchors, they offer the added economies of simplified installation and frill-free construction that resists wind and wintry weather.

American Bridge has been designing, fabricating and erecting transmission towers for the nation's leading power companies for forty-five years. Its experience and facilities are second to none. Why not submit any questions you might have to our nearest Contracting Office? An inquiry involves no obligation.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: AMBRIDGE · BALTIMORE · BOSTON · CHICAGO · CINCINNATI
CLEVELAND · DENVER · DETROIT · DULUTH · ELMIRA · GARY
MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH
PORTLAND, ORE. · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

AMERICAN BRIDGE

UNITED STATES STEEL

SAVE 2/3 ON LAMP COSTS

SAVE THIS – ONE LAMP NOW LASTS AS LONG AS 3.
LAMP COSTS
TIME SPENT REPLACING BURNED-OUT LAMPS
SAVE THIS – LAMPS NEED BE REPLACED ONLY ⅓ AS OFTEN.
WESTINGHOUSE

Westinghouse

FLUORESCENT LAMPS NOW LAST 3 TIMES AS LONG

YET COST NO MORE!

Three times the life, or ⅓ the cost! How ever you look at it, the new Westinghouse Fluorescent Lamps present a story of increased efficiency! You can trim expenses two ways: (1) by having to buy lamps less often, and (2) by having to change lamps less often.

Yes, Westinghouse lamps will last 2½ years in average store installations . . . 3 years in average one-shift offices or factories. Light output, too, has been increased. So, for longer life at lower cost, specify Westinghouse lamps.

Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J.

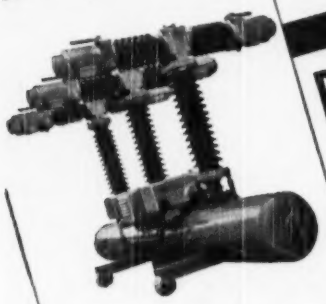
LEADING THE FIELD
Since the war, Westinghouse has scored 35 firsts in producing new and improved light sources

YOU CAN BE SURE...IF IT'S Westinghouse

ADVANCED OR CONVENTIONAL?

Advanced, Of Course—and in Breakers, It's the Air Blast Breaker!

BROWN BOVERI AIR BLAST BREAKERS REQUIRE MINIMUM MAINTENANCE



BROWN BOVERI OUTDOOR AIR BLAST BREAKER
TYPE DCF 80 k 1200

Rated kV — 69
Minimum kV for rated Int. Mva — 60
Insulation Level
Low Frequency 196 kV
Impulse Crest 350 kV
Current Rating
Continuous 800 Amps.
4 Second 20,000 Amps.
Interrupting Rating
1200 Mva 60 to 92 kV
Max. Interrupting Amps: 11,000
Speed: 3 cycles

THE contacts of a Brown Boveri Air Blast Breaker are not damaged even after a heavy short circuit. And, the cooling section of the air blast is so strong that these breakers are guaranteed for 50 full capacity interruptions (many times that number in normal operation) without any parts replacement. Therefore, *maintenance is at a minimum.*

If a check on breaker conditions is desired, (especially on initial operation) inspection is simple and easy. No oil to contend with — no heavy moving parts. All parts to be inspected or maintained can be lifted by one man — one of the many reasons why more and more utilities and industries specify BROWN BOVERI AIR BLAST BREAKERS.

ALL THESE ADVANTAGES . . . *and At No Extra Cost!*

1—HIGH INTERRUPTING CAPACITY—10,000,000 kVA at 230 kV
2—HIGH CURRENT CARRYING CAPACITY—4,000 Amps. at 7.5 kV
3—HIGH SPEED—3 cycles or less
4—NO OIL — NO MESS — NO FIRE
5—QUICK & EASY TO INSPECT
6—MINIMUM MAINTENANCE
7—RAPID RECLOSING—Both 3-phase or single phase.
8—POSITIVE INTERRUPTION UNDER ALL CONDITIONS including short circuits—normal load—magnetizing or charging currents.
9—SAFETY—No secondary damage even if highly overstressed.
10—DEPENDABILITY—15 years of satisfactory performance throughout the world.
11—LOW INITIAL COST & MAINTENANCE—Costs no more than other types of breakers.

WORLD ENGINEERING & MANUFACTURING LEADERSHIP IN MECHANICAL & ELECTRICAL POWER EQUIPMENT—FOR OVER 50 YEARS.

SWITCHGEAR • REGULATORS • RELAYS
MOTORS & TRANSFORMERS • TURBINES

WRITE FOR SPECIFICATIONS AND DATA!

BROWN BOVERI CORP., 19 Rector Street, N. Y. 6

Please send me specifications and details on your ☐ indoor ☐ outdoor air blast breakers for ____kV ____Amps. ____kVA.

Name _____ Title _____

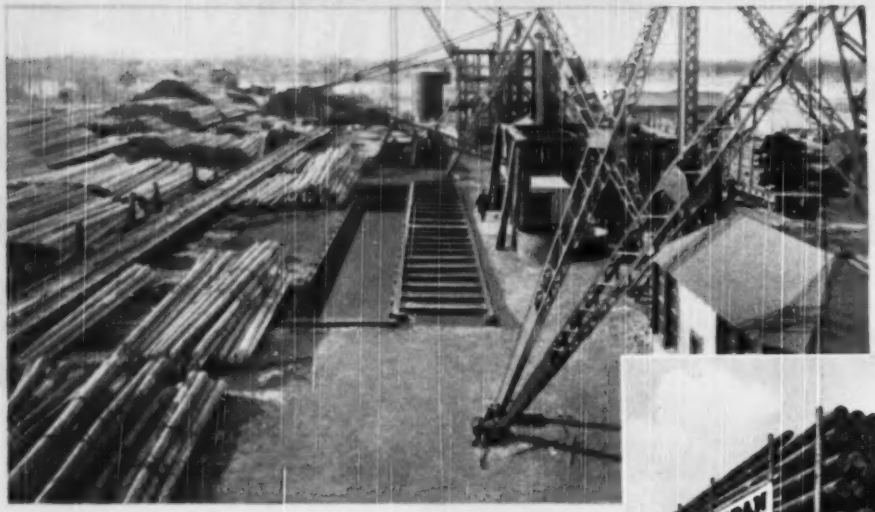
Company _____

Address _____

BROWN BOVERI CORP., 19 Rector St. • New York 6, N. Y.

BROWN BOVERI

SUPPLY UNLIMITED...
Pole Life Unmatched



Actual photo of New Western Red Cedar Stocks in CONSOLIDATED Yards. Photo taken January 3, 1950.

Now . . you can get AMPLE STOCKS of

LIFE-SPAN *treated*

WESTERN RED CEDAR POLES

Large quantities of nature's No. 1 poles, Western Red Cedar, are going through Consolidated Yards daily. There is an ample supply for the big construction jobs that lie ahead.

Nature builds *all* Western Red Cedar Poles on the same remarkable plan . . . same kinds of fibers, same lightness, straightness, durability and strength. There is none finer. Built by Nature . . . perfected by LIFE-SPAN! Submerged full length in first a hot, then a cold pentachlorophenol solution, Western Red Cedar and LIFE-SPAN make an incomparable combination. They are clean from end to end, safe and easy to handle.

LIFE-SPAN Poles mean dependable service up to pole line obsolescence. They're always clean and dry; they offer secure footing to linemen and build good public relations for the companies using them.

To be sure, to be doubly safe . . . specify LIFE-SPAN Western Red Cedar Poles.

The same LIFE-SPAN treatment is also available for Fir, Western Larch and Lodgepole Pine.

CONSOLIDATED TREATING CO.
MINNEAPOLIS, MINNESOTA

PROMPT DELIVERY
from any CONSOLIDATED Supplier

Life Span

Sold only by the following:

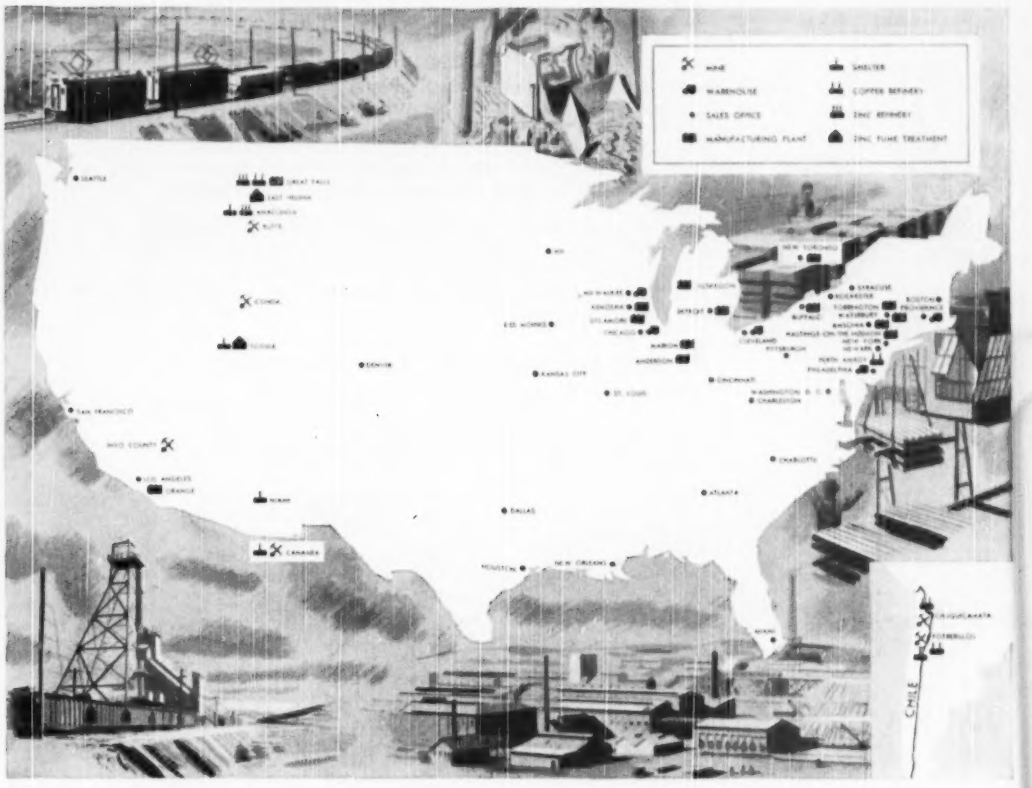
PAGE & HILL, INC.
Minneapolis, Minnesota
50 Church Street, New York, N. Y.

B. J. CARNEY & CO.
Spokane—Minneapolis

SCHAEFER-HITCHCOCK CO.
Sandpoint, Idaho
Suppliers for Joslyn Mfg. & Supply Co.

NAUGLE POLE & TIE CORP.
Chicago, Illinois

This is ANACONDA



...and how it serves us all!

Copper is ANACONDA's job, in addition to important zinc, manganese and by-product metal production. It's the job of insuring a dependable supply of copper so essential to our American way of life.

That is why ANACONDA has become the world's major group of non-ferrous mines, smelters and refineries; why it owns and operates a great network of manufacturing plants, has countrywide sales offices and distributors.

But supplying today's copper is not enough. What about tomorrow? It's ANACONDA's basic policy that *for every ton of copper mined, a ton of new reserves must be developed*. Thus, ANACONDA's resources and facilities assure us all a continuing supply of this vital red metal.

As industry continues to grow, so does the breadth of application of copper and its many versatile alloys. For in the new scientific concepts and industrial techniques, copper plays a constant, integral part, broadening the horizons of industry and of the people industry serves.

ANACONDA COPPER MINING COMPANY

The American Brass Company
Anaconda Wire & Cable Company
International Smelting and Refining Company
Andes Copper Mining Company
Chile Copper Company
Greene Cananea Copper Company

PRODUCE: Copper, Zinc, Lead, Silver, Gold, Cadmium, Vanadium, Superphosphate, Manganese Ore, Ferromanganese

MANUFACTURE: Electrical Wires and Cables. Copper, brass, bronze and other copper alloys in such forms as Sheet, Plate, Tube, Pipe, Rod, Wire, Forgings, Stampings, Extrusions, Flexible Metal Hose and Tubing

Simple Arithmetic Proves

You Can't Beat Creosote Oil* as a Preservative

***Especially U·S·S CREOSOTE OIL**

Divide the total initial cost of a pole treated with creosote oil by the years of service life you can expect. Then apply the same formula to an untreated pole, or to a pole treated with a less-permanent preservative.

Your figures will prove that the annual charge for creosoted poles is much *less* . . . the many extra years of service far offset the cost of creosote oil treatment. Translate these figures into practice and you'll trim your annual pole replacement costs sharply for years to come.

But, for best results and lowest costs, be sure that U·S·S Creosote Oil is used. Its uniform quality, the result of *continuous* processing, makes it possible for you to obtain the same high performance, application after application.

If you are interested in more information, please write to the nearest sales office listed below. There is no obligation.

COAL CHEMICAL SALES DIVISION

UNITED STATES STEEL CORPORATION SUBSIDIARIES

71 Broadway, New York 6, N. Y.

208 South La Salle St., Chicago 90, Ill. 1509 Terminal Tower, Cleveland 13, Ohio
Brown-Marx Building, Birmingham 2, Ala. 25 Beale St., San Francisco 5, Calif.

USS

CREOSOTE OIL

UNITED STATES STEEL

American ACCESSORIES

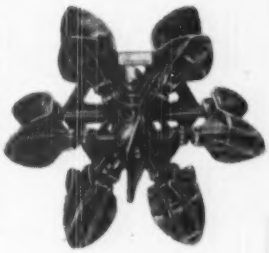
POWER REELS

No. 2006

COLLAPSIBLE POWER REEL for Stringing and Rewinding Wire. Operates from extended winch shaft on side of line construction bodies. To collapse reel for quick removal or mounting of wire coils, rotate hand wheel. Clutch permits disengagement for free rotation.

No. RL-30

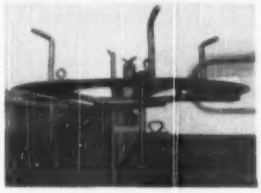
COLLAPSIBLE POWER REEL for Electric, Telephone and Telegraph Companies. Similar to No. 2006 but has no clutch or hand wheel, thus weighs less. Used for taking up wire of all sizes. Collapsible for removing coil. Specifications: Dia. of reel (expanded) 28"; contracted 18¾"; eye diameter of reel 20"; weight 65 lbs.



UNIVERSAL SWIVEL SHEAVE FOR WINCH LINE

American type 4018 mounts at rear of line construction body and is designed to fit the standard eye bolt spacings. Works at any angle. Tension type roller keeps line in proper position. Larger diameter of sheave wheel increases winch line life. Wheel dia. 8"; weight 65 lbs.

PAY-OUT REEL FOR ELECTRIC SERVICE WORK



No. 3906

Used for stringing No. 6 and No. 8 service wire. Can be adjusted to coil sizes. Tension brake. Can be mounted vertically in bodies with roof or tarpaulin covering. 32" dia.—weight 57 lbs. Eye diameter — 22¾" to 18¾".

American

ALL-METAL WATER CASKS, UNBREAKABLE, INSULATED

Here's the cask the crew likes. Full insulation between inner and outer shells assures fresh, cool water for many hours. Constructed entirely of metal with all-welded seams and joints. Lined inside with sanitary, stainless steel. Three sizes: 2, 3 and 5 gals.

★

ALL-PURPOSE PAY-OUT AND TAKE-UP REEL for General Utility Work

No. 3893

Holds full coil of No. 6 or No. 8 service wire. Use either in vertical or horizontal position, when removed from truck body. Tension brake controls reel speed. Height—37"; Dia. 36". Eye diameter—20".

PAY-OUT AND TAKE-UP REEL for Telephone Drop Wire Work

No. 5197

Has adjustable and removable outer spider and adjustable tension brake. Height—27"; Dia. 25". Eye diameter —15".

PLACE ORDERS FOR THESE AND OTHER ACCESSORIES DIRECT OR TO NEAREST DIVISION

THE American COACH & BODY COMPANY

MAIN OFFICE AND PLANT — 9503 WOODLAND AVE., CLEVELAND 4, OHIO
CALIFORNIA DIVISION — 432 FIFTH STREET, OAKLAND 7, CALIFORNIA

SALES OFFICES: INSURANCE EXCHANGE BLDG., DES MOINES 9, IA. · 207 LAKE STREET, MONROE, N. Y. · HEALEY BLDG., ATLANTA, GA.

DISTRIBUTORS: BAKER EQUIPMENT ENGINEERING CO., SUMMIT & NORFOLK STS., RICHMOND 11, VA. · EQUIPMENT SERVICE, INC., 1 WAWARME AVE., HARTFORD 6, CONN.

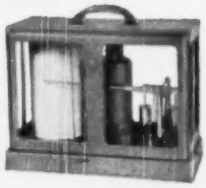
ACB and

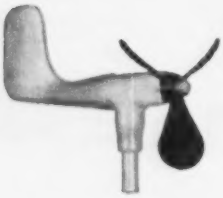
Bendix-Friez INSTRUMENTS

for ANY Weather Condition!

THE AEROVANE* RECORDER —Dual recorder for wind speed and wind direction — ideal instrument for meteorological stations — particularly well adapted to the requirements of industry in general.

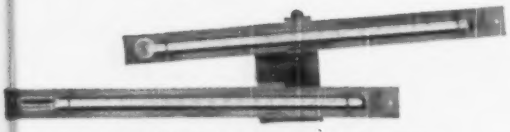
MICROBAROGRAPH — An exceptionally precise recording Barometer. Producing an expanded graph of atmospheric pressure, registers each minute change in atmospheric pressure (within 0.01 inch mercury).





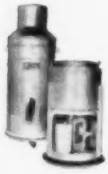
THE AEROVANE* TRANSMITTER — Combines wind speed and direction components in one unit. It consists of a three-bladed molded rotor to measure wind speed, and a streamlined vane for wind direction.

THE AEROVANE* INDICATOR —Indicator Panel supports the two 3¾" indirectly illuminated indicator dials and the indicator mechanisms — a rheostat knob is provided on the face of the panel for regulating the dial illumination.



MAXIMUM-MINIMUM THERMOMETERS are in service at all meteorological and climatological stations to collect basic climatic data. Maximum and Minimum Thermometers provide an easy method for determining extremes of temperature over any desired period.

UNIVERSAL RECORDING RAIN GAGE — The universal Recording Rain and Snow Gage is designed and constructed to assure durability and long life under severe weather conditions. All forms of precipitation—rain, hail, sleet and snow—may be measured.

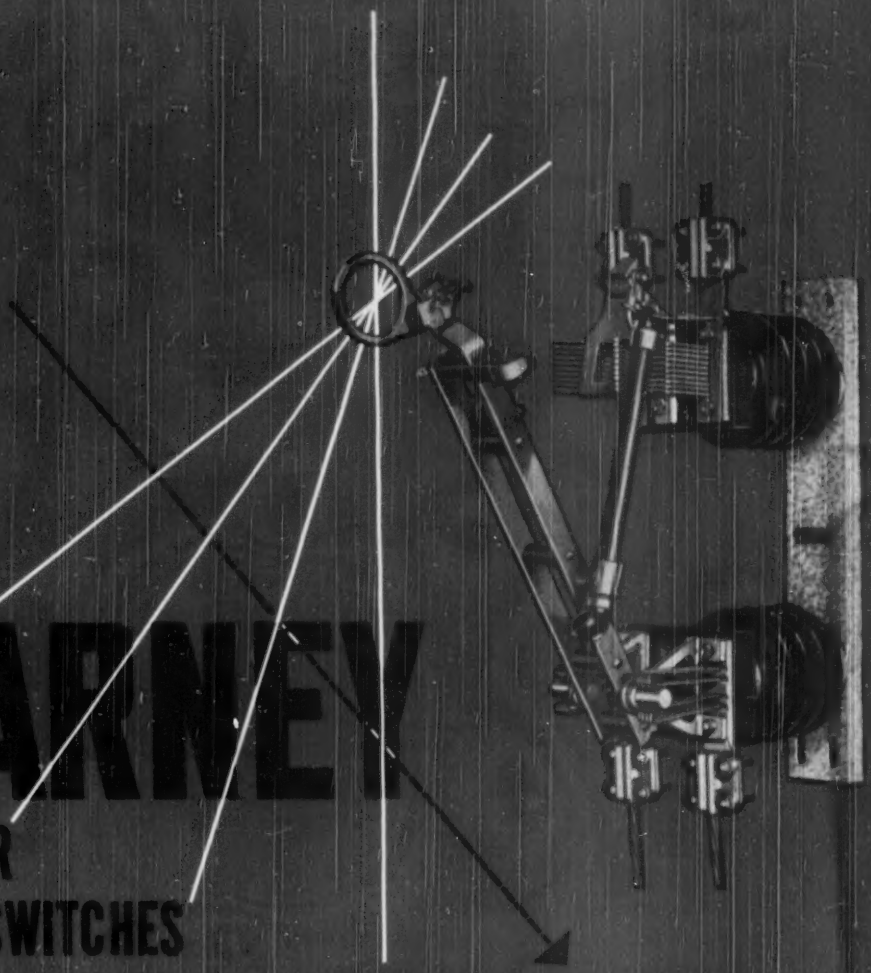


Whatever your needs for weather data, and wherever you need to collect them, BENDIX-FRIEZ makes the proper instrument for the purpose. Manufacturers of the world's finest meteorological instruments and principal supplier to the United States Weather Bureau for over 73 years. Prices and literature on request. *REG. U. S. PAT. OFF.

WRITE: *FRIEZ INSTRUMENT DIVISION of*
1376 Taylor Avenue • Baltimore 4, Maryland
Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

Bendix AVIATION CORPORATION

Source of the World's Finest Weather Instruments



with

KEARNEY

REGULATOR BY-PASS SWITCHES

YOU PULL ONE SWITCH RING to Perform FOUR Distinct Switching Operations

Kearney Regulator By-Pass Disconnect Switches were developed for one specific purpose—to by-pass or remove voltage regulators from service. They perform this function safely and automatically because, when one ring is pulled, the following operations occur:

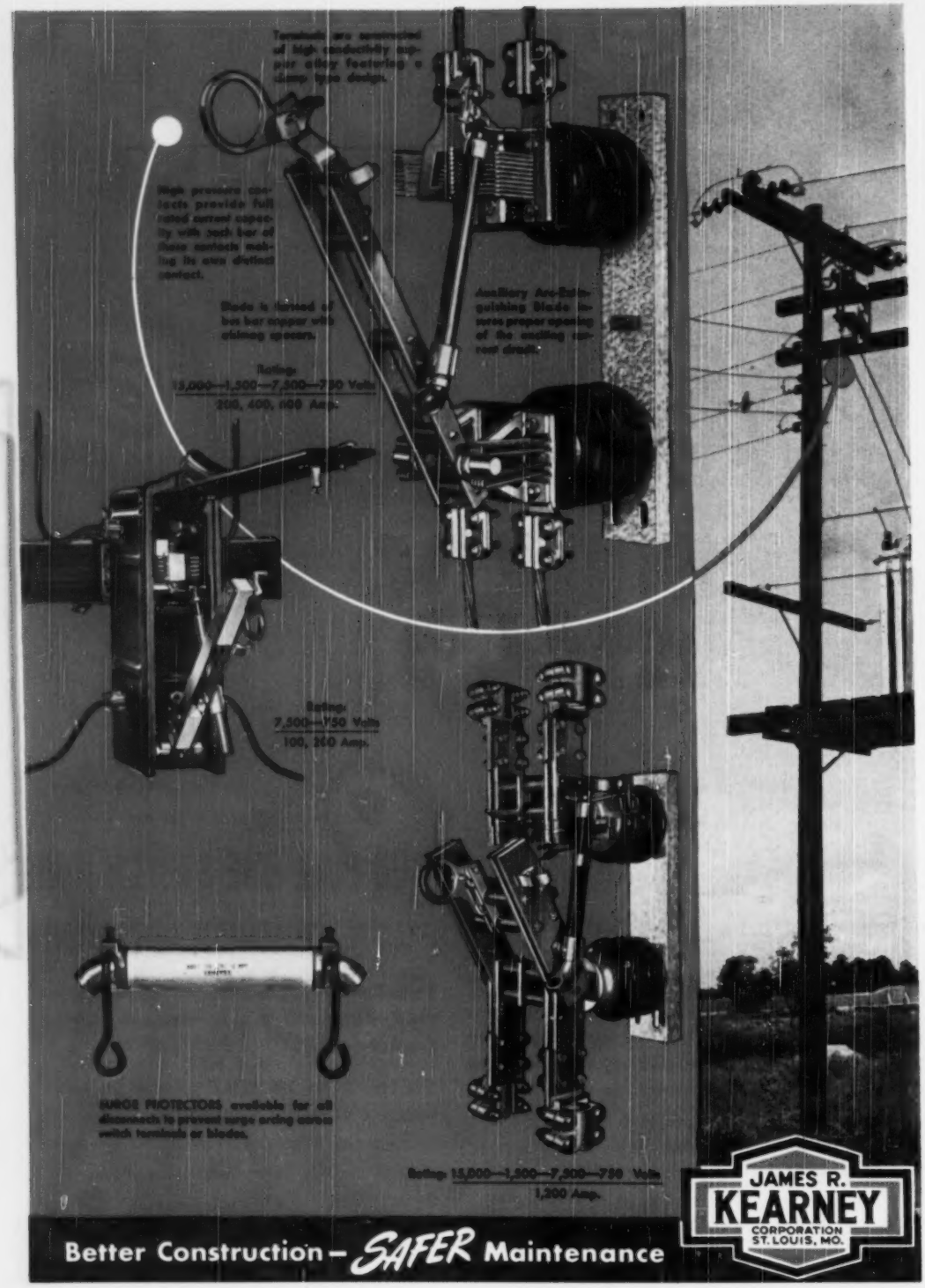
1. The regulator is by-passed
2. 3. Both leads to regulator are opened
4. The exciting current is interrupted

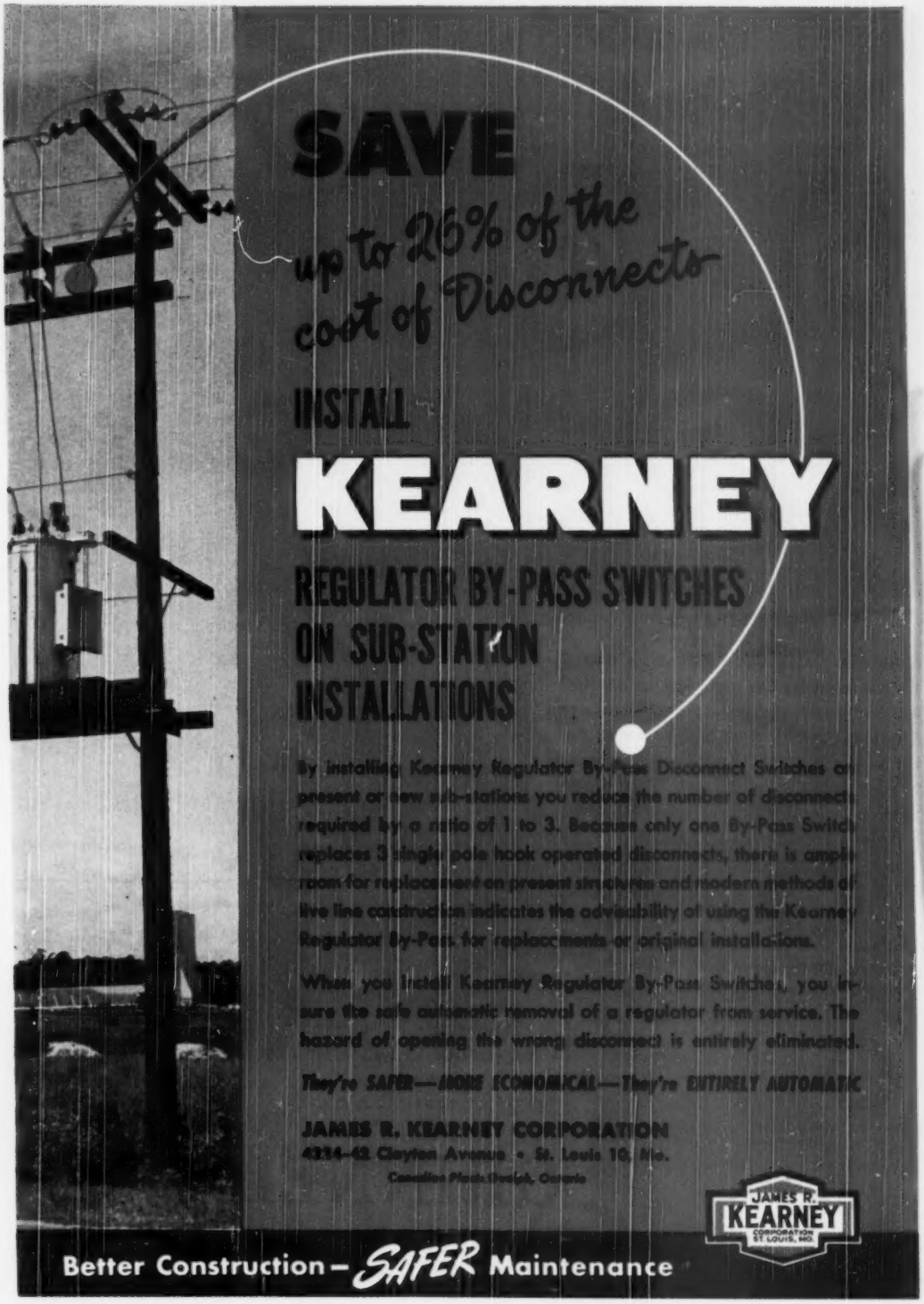
To restore the regulator to service you reclose the By-Pass Switch as you would any other disconnect switch.

You can do the job safely because the proper sequence of switching is built in — economically because one Regulator By-Pass Switch replaces three single pole hook operated switches.

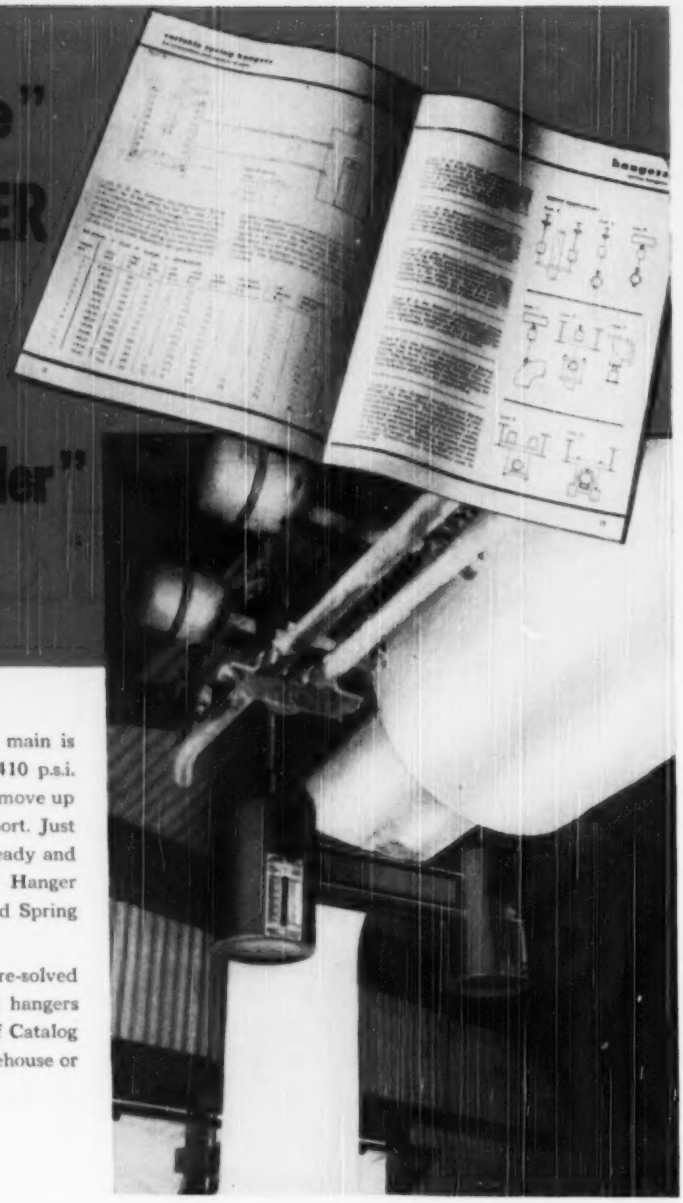
Always Specify JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *for the Job...*

SEE FOLLOWING PAGES FOR MORE DETAILED INFORMATION


Terminals are constructed of high conductivity copper alloy featuring a clamp type design.
High pressure contacts provide full rated current capacity with each bar of flame contacts making its own distinct contact.
Blade is formed of bar copper with arcing spacers.
Rating:
15,000—1,500—7,500—750 Volts
200, 400, 600 Amp.
Auxiliary Arc-Extinguishing Blade insures proper opening of the enabling current circuit.
Rating:
7,500—750 Volts
100, 200 Amp.
SURGE PROTECTORS available for all disconnects to prevent surge arcing across switch terminals or blades.
Rating: 15,000—1,500—7,500—750 Volts
1,200 Amp.
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.
Better Construction — SAFER Maintenance


SAVE
up to 26% of the cost of Disconnects
INSTALL
KEARNEY
REGULATOR BY-PASS SWITCHES ON SUB-STATION INSTALLATIONS
By installing Kearney Regulator By-Pass Disconnect Switches at present or new sub-stations you reduce the number of disconnects required by a ratio of 1 to 3. Because only one By-Pass Switch replaces 3 single pole hook operated disconnects, there is ample room for replacement on present structures and modern methods of live line construction indicates the advisability of using the Kearney Regulator By-Pass for replacements or original installations.
When you install Kearney Regulator By-Pass Switches, you insure the safe automatic removal of a regulator from service. The hazard of opening the wrong disconnect is entirely eliminated.
They're SAFER—MORE ECONOMICAL—They're ENTIRELY AUTOMATIC
JAMES R. KEARNEY CORPORATION
4214-42 Clayton Avenue • St. Louis 10, Mo.
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.
Better Construction – SAFER Maintenance

"Ready-made" PIPE HANGER for a "made-to-order" FIT



Look how closely this 8-inch steam main is tucked up under the roof. And, at 410 p.s.i. and 550° F., this piping was bound to move up and down enough to need flexible support. Just the hanger to fit this situation was ready and waiting right in the Grinnell Pipe Hanger Catalog 10-D . . . the Pre-Engineered Spring Hanger fig. B268, type G.

Every pipe suspension problem is pre-solved for you by Grinnell ready-to-install hangers and supports. You can get a copy of Catalog 10-D from your Grinnell branch warehouse or local Grinnell jobber.

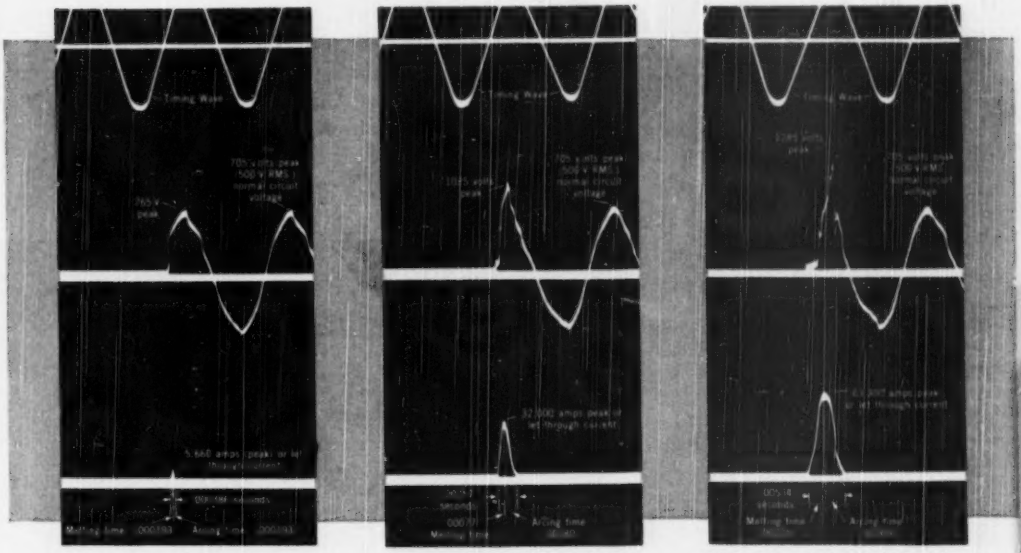
100th ANNIVERSARY PIPING

GRINNELL

Grinnell Company, Inc., Providence 1, R. I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

UNBELIEVABLE

UNTIL THESE CERTIFIED OSCILLOGRAMS SHOW YOU ACTUAL INTERRUPTING TEST RESULTS



30 ampere, 600 volt Shawmut Amp-trap. Available current: 118,000 amps. RMS. 202,000 amps. Peak.

400 ampere, 600 volt Shawmut Amp-trap. Available current: 118,000 amps. RMS. 202,000 amps. Peak.

1000 ampere, 600 volt Shawmut Amp-trap. Available current: 85,000 amps. RMS. 144,000 amps. Peak.

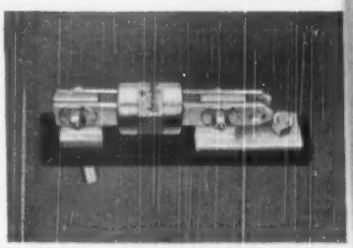
SHAWMUT Amp-trap* CURRENT LIMITERS

...the ultimate in low-voltage circuit protection

These interrupting tests on Amp-traps were successfully performed in a high capacity testing laboratory at 500 volts, 60 cycle, fully offset wave, in accordance with A.I.E.E. Standards #25 on Power Fuses, and were witnessed and certified by Electrical Testing Laboratories.

Never before in electrical history, so far as we know, has any circuit protecting device combined such lightning-fast current limiting and interrupting action. Amp-traps are built in sizes from ¼ ampere to 3000 amperes for application on circuits up to 600 volts A.C. or D.C. Amp-traps' operating temperatures are relatively low.

It will pay you to investigate how the Shawmut Amp-trap design operates without noise or flame. Fill out and send the coupon below, to get proof of amazing Amp-trap performance.



A 1600 ampere Amp-trap mounted in special fuse holders with spring washers — for application on circuits up to 600 volts A. C. or D. C.

*Trade-Mark "Amp-trap" Registered U. S. Patent Office

REGISTERED UNITED STATES PATENT OFFICE

SHAWMUT
CIRCUIT-MATCHED CURRENT LIMITERS

Insure more accurately engineered protection for any circuit

THE CHASE-SHAWMUT COMPANY
370 Merrimac Street, Newburyport, Massachusetts

I am interested in more information about the Shawmut Amp-trap device, particularly for

- ☐ new electrical installations
- ☐ old electrical systems
- ☐ incorporation in such equipment as switchgear, station auxiliary buses, meter starters, bus ducts and cable systems

Name.....Title.....

Firm.....

Street.....

City.....Zone.....State.....

☐ Check here for information on C-Q-T, the startling new Plug Fuse with Time-Delay sufficient to start a heavy washing machine, yet sensitive enough to protect lamp cords.

Trends in POWER

- GENERATION
- DISTRIBUTION
- UTILIZATION

A SPACE SAVING oval condenser . . . a revolutionary tube type motor . . . and transformers with corona free construction — *all Allis-Chalmers built* — are shown. Installations like these reveal today's trends in power. These advanced designs meet demands for efficiency and economy due to rising costs of fuel, labor and construction.

Take advantage of A-C's wide background of experience in building major apparatus for electric power . . . that makes Allis-Chalmers a good name to know. Call your nearby A-C representative about this equipment, or write direct.

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

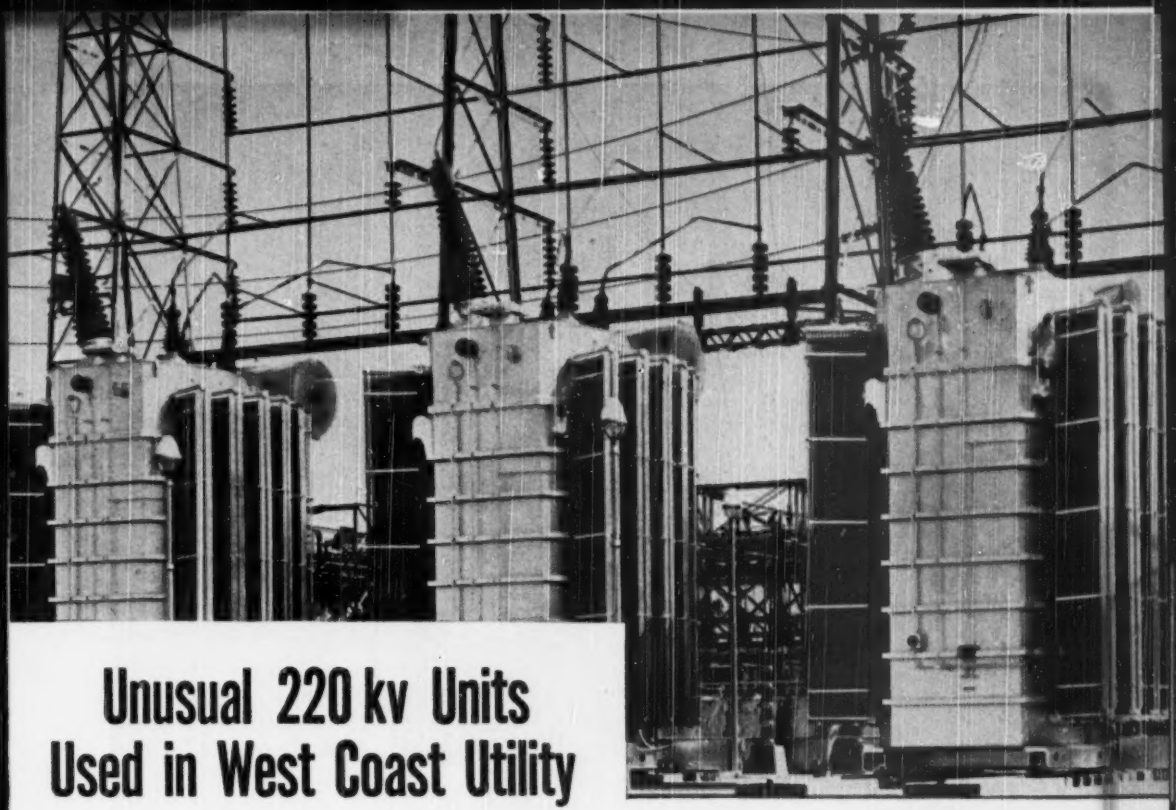
Oval Shape Condenser Saves Space at Dayton Power & Light Co.

Two of these Allis-Chalmers 45,000 square foot multi-steam pass condensers are now in operation at the new O. H. Hutchings Station. Two more are being installed. Serving each condenser are two Allis-Chalmers vertical mixed flow circulating pumps and motors. By making the condenser oval in shape and placing the A-C vertical condensate pumps and motors in a separate hotwell to the side of the condenser, it was possible to keep the height between the turbine and the basement floors to a minimum. A-2952

Equipment for Power: Water Conditioning equipment, chemicals and service . . . Steam and Hydraulic Turbines . . . Generators . . . Condensers . . . Steam Jet Air Ejectors . . . Power Plant Pumps and Motors . . . Transformers . . . Circuit Breakers . . . Switchboards and Control . . . Switchgear . . . Unit Substations . . . Utilization equipment.

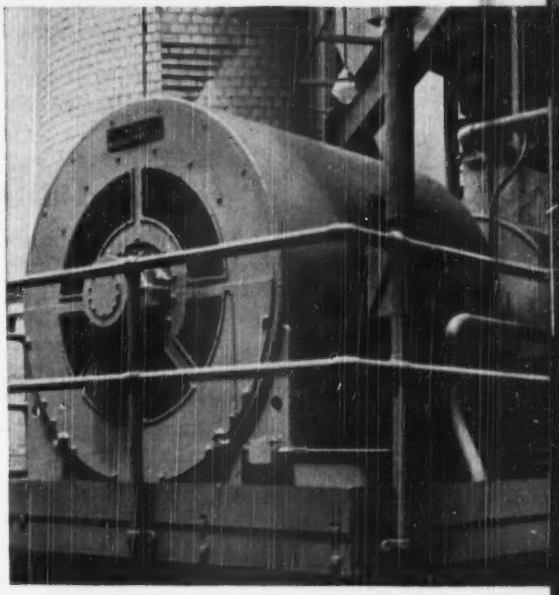
ALLIS-

Pioneers in Power and



Unusual 220 kv Units Used in West Coast Utility

In line with the increased usage of high voltage transmission is the installation of these three 220,000 volt transformers. Their corona-free insulation is especially important in making these transformers long lived and strong without deterioration under severest impulse voltages . . . even when repeated time after time. A feature of these units is the load ratio control on the low voltage (72,000 volt) winding, which is unusual for a transformer of this size. Each unit is single phase and rated 25,000 kva.



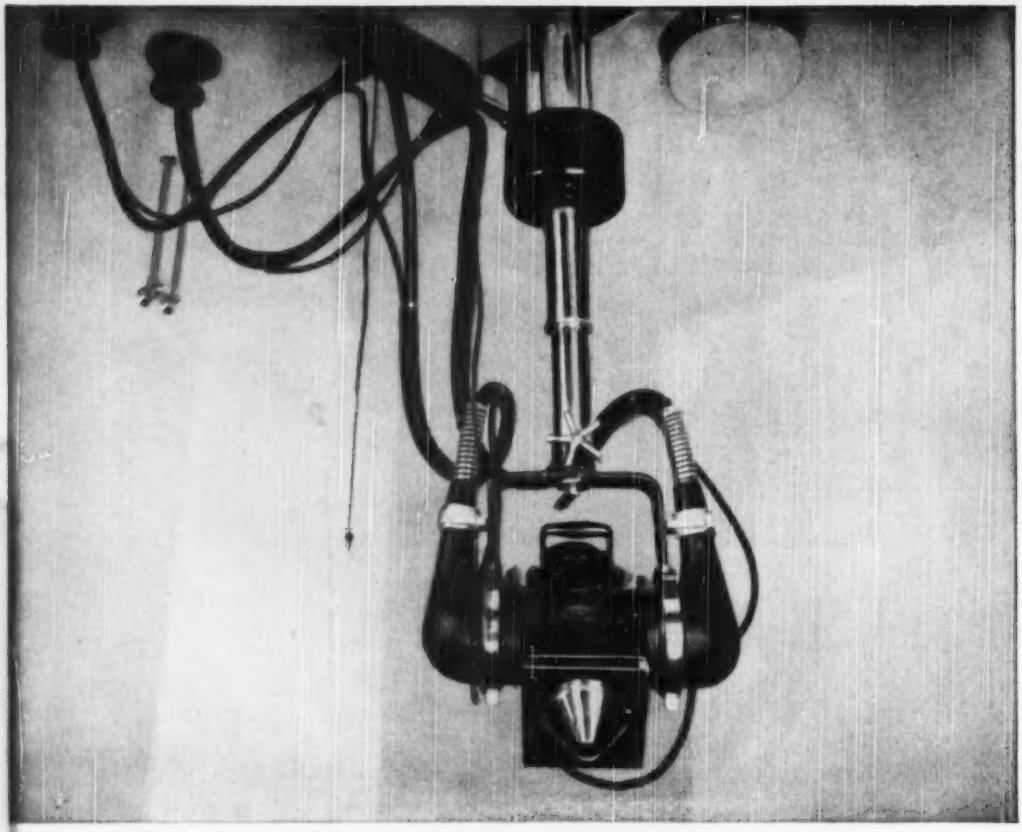
Public Service Electric & Gas Co., N.J. ...46 Motors

Tube type totally enclosed, fan-cooled motor shown is one of 46 large Allis-Chalmers motors at Sewaren. Tube type, fan cooled design is well suited to this type of outdoor draft fan operation. The motor rarely, if ever, needs cleaning because tubes are straight, air passages are unrestricted, and the cooling air flows at sufficient speed to carry foreign matter out with it. This motor is ideal for hazardous or dirty locations indoors or outdoors.

CHALMERS

A-C ALLIS-CHALMERS

Electrical Equipment From Generation Through Utilization



Kerite insulation withstands the dielectric and physical stresses of commercial x-ray use.

The Cable Nobody Could Build

CABLE insulation takes a beating in commercial x-ray service. It is subjected to constant flexing at short radius, under high voltage stress, and over a wide temperature range. For years, x-ray cable failures were common occurrences until the problem was given to the engineers of the Kerite Company.

The answer was found with the first lengths of Kerite x-ray cable manufactured. Today Kerite cable is standard equipment on many x-ray machines.

Perhaps *your* cable problem can be solved by Kerite-insulated cable. It costs nothing to find out. Kerite-insulated wire and cable is made for a wide variety of power and signal-system applications. Ask any Kerite user about its remarkable stamina and low cost per year. *The Kerite Company, 30 Church Street, New York 7, N. Y.*

Offices also at: 122 S. Michigan Ave., Chicago 3; 582 Market St., San Francisco 4; 714 W. Olympic Blvd., Los Angeles 15.

Kerite Insulation—Your Cable's Best Life Insurance

KERITE CABLE

START OF AN ERA

ACADEMICIANS STILL have their debate as to whether 1950 is the last year of an old half-century or the start of a new one. But there is little room to question that it's the first year of a new era for the nation's privately owned electric utilities.

Already there have been unmistakable signs that the industry is making a sweeping revision of approach to its most serious problem—public ownership. In several important areas it has been facing up to this threat with new spirit, new determination, and, best of all, new ideas.

The most spectacular demonstration has been the fight to save Pacific Power & Light Co for private enterprise. In the early skirmishing, with Pacific's fate still unsettled, the private enterprise forces won a preliminary victory.

This victory was sealed when financial backing emerged for a private ownership offer to counter the proposal to sell Pacific to a group organized to transfer the system, or much of it, to public ownership and management. At that point the industry had accomplished more than it had been able to achieve before in Tennessee, Nebraska, or any other arena of decisive conflict with public ownership. The men fighting for private ownership of Pacific had come up with an alternate plan, superior in many vital aspects to that of the opposition.

The most important step in developing this plan was the decision by Pacific's local officers and friends to fight for the property. The decision was swift. It had to be. There was little warning of the deal to sell out to public ownership.

Another vital factor was the impressive showing of public support for private ownership. Newspapers, including some which previously had sympathized with the public power line, almost unanimously decried the sellout. And protests came from many other local sources.

Still the company had little hope of survival without more concrete backing. Hard dollars were required. And hard dollars might well have been scared away by talk emanating from Pacific's parent holding company. According to this supposedly responsible source, private ownership was all washed up in the Northwest. But, despite this gloomy prediction, money was found—$15 million in hard, private ownership cash.

The significance to the industry is clear. If private management acts quickly and intelligently, both public sentiment and financial support will rally to its cause.

Fortunately, the industry is applying this technique elsewhere as well as in the Pacific Northwest. Under entirely different circumstances, power companies in the Southwest also are working vigorously and intelligently to solve a vicious public ownership threat.

These cases indicate that the days of mere complaining and crying over spilt milk are coming to an end, as they must if the private electric utility industry is to survive. With the industry more united and cooperating on a wider basis than ever before, it does not seem premature to hail a new era of activity on the ownership front. And judging by the returns to date, it looks like a most promising period.

The Consumers Power Decision

WHEN A regulatory commission says, "We are of the opinion that a fair rate of return to be applied to the fair value should be 5.7% and that fair value is 37% above depreciated original cost," that is more than ordinary news. In summary form, this was the decision of the Michigan Public Service Commission in granting a rate increase of $4,180,000 to Consumers Power Co.

The Commission staff set the depreciated original cost of the property rate base at $241 million compared with a company study showing a reproduction cost new value of $413 million. In presenting its case the company maintained that a proper rate base is the fair value of its property and that such a value lies somewhere between the original cost and the reproduction cost new. The PSC agreed with this line of reasoning, which had also been prescribed by the Michigan Legislature and Supreme Court, and set the fair value rate base at $330 million.

In discussing other trends in rate making procedure, the Commission stated that "the original cost theory commends itself by sheer simplicity of administration; but during inflationary periods it assumes alarming aspects, and it may equally prove to be alarming during a period of deflation." When considering the question of rate of return the Commission stated that "In determining a reasonable rate of return, we deem it necessary to consider the cost of money, the company's financial structure, its construction program, and its need for raising additional capital." In making a final determination of the amount, they apparently used as one consideration the company's testimony showing a cost of money of 5.56% in 1948. A return of 6% was requested.

This Michigan Commission decision may not be of universal importance because of the unequivocal reliance, in some states, on original cost. But it should not be overlooked that in two previous Michigan cases, the Michigan Bell and Detroit Edison Co decisions, original cost was used as the primary element in setting the rate base.

The forthright presentation of relative facts by the Consumers Power Co witnesses and the resulting Commission decision should provide a real incentive and the green signal for others in their fight for fair treatment before state commissions.

A Small Box for Frozen Foods

"I WISH we had one of those refrigerators with frozen food compartments. We don't really need a great big freezer. My refrigerator is still good, but I would like a place to keep frozen foods."

In how many homes are similar thoughts expressed by the housewife? We have no idea. We know that some are thinking that way because the paragraph in quotes above sums up remarks caught by the editorial ear at a showing of the 1950 refrigerator line of a large manufacturer.

Would it be possible to hook up an evaporator in a box holding about 50 lb to the compressor of a standard refrigerator? Or would the cabinet require refrigerating equipment of its own? If so, could it be produced at low enough cost? It is up to the manufacturers to answer these questions promptly.

University Research

UNIVERSITY RESEARCH in the electric power field went to a low level during the war because of the pressure for electronic developments, and it has recovered comparatively little of its lost ground. Authority for such an assertion can be found in a statistical analysis of the review of current research by the Engineering College Research Council of the American Society for Engineering Education.

The report lists some 3,125 projects in 89 institutions, and of these 375 are being conducted in electrical engineering departments. Of the latter only 126 (a mere third) can be inferred to be power rather than electronic in nature. In fact if it were not for a few schools like Harvard (11), Tennessee (8), Northwestern (6), and Oklahoma A&M (7) the "power" showing would be that much poorer. A mere handful of these researches are of primary direct interest to the utilities, e.g., galloping conductors, conductor connectors, electric house heating. The rest have to do with the cognate fields of welding, illumination, electric machinery, analyzers, servomechanisms, industrial applications.

Of course the power industry will benefit more or less directly by the fruits of researches in heat power, chemistry, biophysics, and electro-medicine, but the point is that barely one-tenth of one percent of the current research is devoted to problems originating from or sponsored by the electric utility industry. It certainly cannot be that the problems have all been solved or that all the remaining ones should be solved in the laboratories of the electrical equipment manufacturers.

The way to back up the loyal "power course" electrical professors is to give them power researches to engage their professional interest and apply their graduate students. Otherwise the lure of electronics and the military subsidies will absorb all the facilities, all the talent, all the embryo cadets that could otherwise be headed for future employment by the utilities.

Back in the lush "thirties" the old NELA sponsored some researches that the stirring Federal Trade Commission dubbed impure regardless of the sincerity with which they were conceived. That kind of political roundup has no counterpart in the present situation. There are plenty of problems—technical and technical-economic—confronting the utilities, and some of them can well be delegated to the schools without any more fear than the chemical and aviation and other industries have that their motives in supporting free institutions in research will be impugned.

The Electrical Week

Canadian utilities, both government and investor-owned, are adding new capacity at a record rate. But consumption of electricity is increasing so rapidly that utilities are making little progress in building up their reserve capacity . . . The Securities and Exchange Commission has opened hearings in Washington on the sale of the Pacific Power & Light Co. Point of controversy at present is whether the Van Ingen proposal, a negotiated deal, should be exempt from the competitive bidding requirement . . . In REA's report for fiscal 1949, Administrator Claude Wickard vigorously defended REA loans for generation and transmission. The report also indicated that REA had the most successful year in its history . . . Peace has come between public power and the investor-owned companies in the Southwest. So believes SPA Administrator Douglas Wright, who is making contracts between SPA and the private companies for "wheeling" of government-produced power . . . And output edged up in the week ended Jan 21 to 6.04 billion kwhr, a record high.

The Chamber of Commerce of the United States has come out "strongly opposed to regional authorities," warns that Fair Deal CVA may be new step toward nine Valley authorities.

The British are ready to adopt the American practice of inspecting transmission lines from an airplane. The use of short-wave radio to contact trouble crews is another American innovation that British utility men here on an ECA-sponsored tour want to take back home.

Cleveland Electric Illuminating Co's pension plan is being hailed by the CIO Utility Workers Union as one of the best in the country. Supported entirely by CEI, it pays a minimun pension of $60 a month, $1,000 maximum, exclusive of Social Security at age 65 (60 for women) after 20 years of service. Total pension payments during a year equal 2% of a worker's total earnings with the company.

Latest U. S. Department of Commerce figures show that November sales of electrical goods wholesalers showed little or no change from October but were 12% under November 1948.

Last known obstacle to completion of New England Power's Wilder Dam has been removed by the signing of a flowage deed by the lone remaining opponent of the 385-ft level. Redevelopment from 5,000 to 30,000 kw is progressing rapidly.

Some co-ops are starting to needle REA about the fact that it isn't loaning money quite as fast as it did a year or so ago. One answer may be in Administrator Wickard's new report for fiscal year ended last June 30. Wickard explains that as REA moves into "more difficult-to-serve areas" it "may have to limit its consideration to fewer applications" to avoid lowering standards for economic feasibility.

Another state labor law has been upheld by the Supreme Court. It is the Arkansas statute forbidding picket-line force and violence aimed at keeping workers from their jobs.

Ho-Hum Department—In year-end statements officials of all manufacturing companies connected in any way with television agreed that it is not only here to stay but also will grow to greater heights in 1950.

Norway, Sweden, and Denmark are planning to interconnect their power systems. Sweden and Denmark have been interconnected by a submarine cable since 1914.

Florida Power & Light Co reports that in the past four years it has increased its generating capacity 73% to serve 51% more customers.

Is electrical heating too expensive? EW editors say, "No, not for some people." Utilities might well investigate the possibilities.

Notes From The News

The Ohio Bureau of Criminal Identification is investigating a case of apparent sabotage at the Philo Plant of Ohio Power Co. Brass filings were found in a motor . . . The Gould Paper Co, Lyons, N. Y., wants to sell its electric plant and system to the Niagara Mohawk Power Corp . . . Public Service Co of New Hampshire has asked the Public Service Commission to investigate its rates. The company claims that its 1950 rate of return will not exceed 4%. It wants more revenue . . . The City of Chicago may turn to Commonwealth Edison Co to furnish electricity for street lighting and other purposes. The Chicago Sanitary District has been the supplier for 40 years.

Canadian Demand Pushes Suppliers

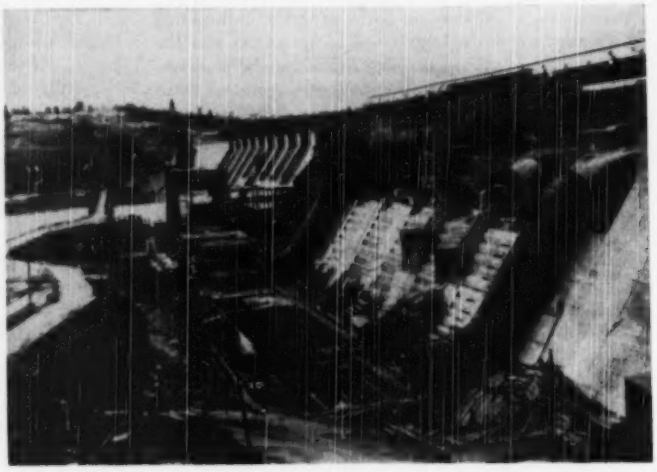
Steady Increase in Capacity Fails to Build Up Reserve Margin as More Power Is Demanded by Consumers; 620,000 Hp Will Go on Line This Year

IF CANADIANS WOULD only be satisfied with the amount of electricity they are consuming today, in about five years Canadian utilities would be in excellent shape and have all the reserves they need. But like their neighbors in the United States, Canadians want to use more electricity not less. The result is that power suppliers in the Dominion are getting nowhere. As soon as a new plant goes on the line, the consumers take all of the power produced. There is nothing left for the supplier to do but build another plant or perhaps add another unit or two.

The utilities, both public and private, are building new plants at a rate well above the 300,000-hp prewar rate. In 1949 total hydro capacity added totaled 480,200 hp. Only 300-hp was scrapped; so there was a net gain of 479,900 hp. Since Canada relies on hydro plants for approximately 98% of its power requirements, thermal plants mean little. However, nearly 60,000 kw of thermal plants were also put in operation.

But the power suppliers are looking to the future. In 1950 over 620,000 hp of hydro capacity is scheduled to go on the line. In future years 1,762,300 hp is planned.

Thermal plants are not being neglected. The 1950 program calls for an increase of 114,750 kw. In the years following 455,000 kw are to be added. Most of this capacity is to be installed in the Province of Ontario which needs steam badly in its highly industrialized and urban southern area.



IN EASTERN CANADA one of the largest projects under construction is the Des Joachims Project of the Hydro-Electric Power Commission of Ontario. The Ottawa River plant will have eight 60,000-hp units; first three will be in operation this summer. This photo shows construction progress on main dam and powerhouse as viewed from Quebec side

Factors that complicate the power situation in Canada are the growing demand for power by industrial customers, rural electrification, and unfavorable water conditions. Canadian industries are electrifying to cut costs and improve production. Even the mining industry in the far north is demanding and getting power for its operations. The farmers want all the modern electrically driven labor saving devices. In all of the provinces rural electrification programs are underway despite the fact that in some areas the initial costs are far greater than those anywhere in the United States.

And in eastern Canada in particular, rainfall has been below normal much of the year. This has led to rationing and restrictions on the use of power in certain provinces. But these restrictions are not so severe at present as in the past few years.

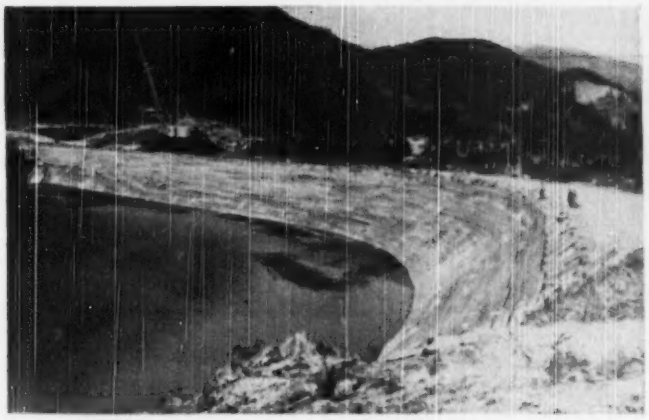
It was low stream flow that in 1948 reduced energy output from 44,986,364,000 kwhr in 1947 (record production year) to 44,568,849,000 kwhr. Production in 1949 set a record, but the exact figures have not yet been released. For the first 11 months of the year production totaled 42,633,419,000 kwhr.

But primary consumption has been increasing much faster than total energy production. In all but one of the last 40 months for which figures are available primary consumption for that month exceeded that for the corresponding month a year previous. The one

Canadian Power Plant Expansion

Province or Territory	Hydroelectric[1]					Thermal[2]		
	Potential Available	Developed Capacity	Installed 1949	Planned 1950	Planned Future	Installed 1949	Planned 1950	Planned Future
British Columbia	10,998,000	1,238,069	228,600	77,000	100,000	.....	.....	.....
Northwest Territory	813,500	28,469	400	.....	1,200	.....	.....	.....
Alberta	1,258,000	106,560	.....	62,000	26,600	34,200	.....	.....
Saskatchewan	1,082,000	111,835	.....	.....	.....	3,200	.....	.....
Manitoba	5,344,500	557,700	54,000	37,500	158,500	11,466	.....	11,250
Ontario	7,261,400	2,896,540	2,300	372,950	756,000	.....	61,000	440,000
Quebec	13,064,000	6,130,097	190,400	42,000	720,000	.....	.....	.....
Maritime Provinces	302,700	281,348	4,500	17,000	.....	15,000	53,750	.....
Newfoundland	272,050[3]	272,050	.....	16,350	.....	.....	.....	.....
Canada	40,396,150[4]	11,622,668	480,200	624,800	1,762,300	63,866	114,750	451,250

[1]Figures in horsepower. [2]Figures in kilowatts. [3]Survey not yet made.
[4]At ordinary six months flow. Engineers estimate 52 million hp of turbines can be installed.

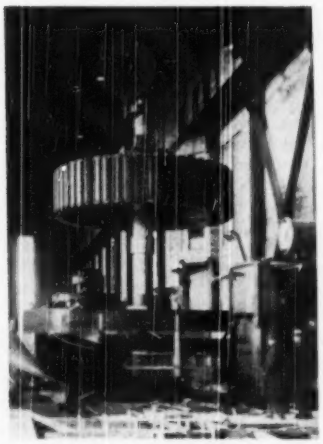


IN WESTERN CANADA British Columbia Electric Railway Co has built LaJoie Falls Dam to impound water for its Bridge River Project. The rockfill dam is 1,400 ft long, 200 ft high and has a maximum width at the base of 470 ft. Storage capacity is 175,000 acre ft

exception was February, 1949, which was slightly below.

In 1945 when total production was 40,100,608,000 kwhr, primary usage was 30,823,539,000 kwhr. For the first 11 months of 1949 output was 42,633,-419,000 kwhr, but primary consumption was 38,362,658,000 kwhr. Secondary power, which is in great demand by industries, has almost disappeared.

Of interest to Americans are the energy exports to this country. These decreased steadily from 1945 through 1948. Early in 1949 there was a slight upswing. From figures available it appears that 1949 gross imports would be a trifle higher than the 1,743,067,000 kwhr reported for 1948. This year exports may once more swing upward because the Pacific Northwest is ready to take any surplus made available by new capacity in British Columbia.



IN CENTRAL CANADA Winnipeg Electric Co is installing two 37,500-hp units at its Seven Sisters Falls Plant on the Winnipeg River. These units will bring total plant capacity to 187,500 hp

•

B. W. Creim Named Head of Southeastern Power

B. W. Creim, regional power manager for the Bureau of Reclamation's Region II with headquarters at Sacramento, Calif., has been appointed administrator of the Department of Interior's new Southeastern Power Administration. (EW, Nov 19, p 88).

Choice of the Reclamation engineer was disclosed to the Interior subcommittee of the House Committee on Appropriations Jan 10. No decision has been reached on headquarters for the new power agency, the Committee was told.

Creim was a captain in the U. S. Navy during World War II and previously served as an engineer with the Bonneville Power Administration.

•

Co-op Opposes Order

The Choctaw Electric Cooperative, Inc, has asked the Oklahoma Supreme Court to reconsider action forcing it to give service to the public. The co-op is under a Pushmataha County District Court order to build a line to the home of W. W. Redman, near Antlers. It asked the Supreme Court to dissolve the order, but the court refused to review the case.

Choctaw maintains it is not a public utility and is under no obligation to give electric service to the public.

January Blizzards Cut Service in Northwest

Mid-January blizzards knocked out a score of power lines from northern California to British Columbia, stopping or curtailing service for periods ranging from a few minutes up to a week.

Pacific Gas & Electric lines serving Eureka, Calif., in Humboldt County, were out for several days, forcing a shutdown of sawmilling operations. One 60-kva line was still down at the end of a week. Domestic needs were supplied by local steam units.

Blizzards Trap Crew

A PG&E line crew restoring Humboldt County service was trapped, out of food, by blizzards in the Trinity mountains. Reached by a snow-cat and plane with food supplies, the six men stayed on the job.

An ice storm which climaxed two weeks of freezing weather darkened a widespread area in northwestern Oregon and southern Washington the night of Jan 19.

Areas served by Portland General Electric and the Clark County PUD were hardest hit, with the latter suffering a complete breakdown.

To complicate the situation, telephone communications from a number of towns were cut off, delaying reports on the location of outages.

PUD Towns Hit

Ridgefield, Battle Ground, Camas, La Center, Amboy and Yacolt, all served by the PUD, were without electricity through the night and most of the following day.

High tension PG&E lines between Portland and St Helens, Ore., were out, interrupting service west of Portland. City lines in high areas of Portland also were down.

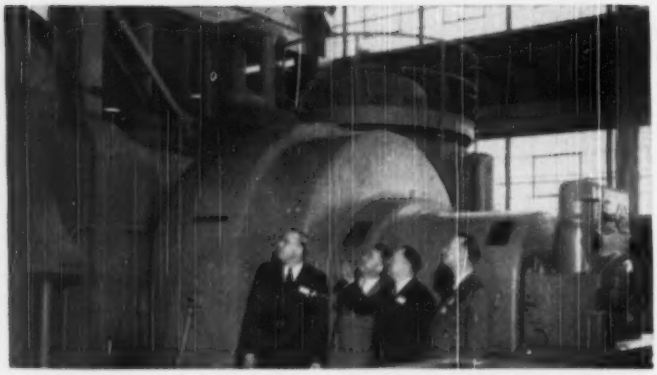
PG&E lines between Portland and Forest Grove also went out, leaving Forest Grove and McMinnville without power for several hours.

Pacific Power & Light Co, Puget Sound Power & Light Co, and Seattle City Light escaped with small damage.

British Columbia's Upper Fraser Valley power lines snapped under an inch or more of ice brought by freezing rain, leaving some five towns and villages and surrounding rural areas without power. All telephone and telegraph lines to eastern Canada were cut off.

In Victoria on Vancouver Island, an ice-coated line broke, cutting off midtown power for nearly two hours.

Extended cold weather brought record demands on the Northwest Power Pool. Between 5 and 6 PM, Jan 17, the



AT OPENING of Schiller Station of Public Service Co of New Hampshire at Portsmouth a tour of the plant is made by two General Electric Co officials. Left to right are W. V. O'Brien, general sales manager of GE's Apparatus Department; C. E. H. Palmer, GE's New England District manager; Avery R. Schiller, Public Service president; and Orville Evans, Eastern Division manager for the utility. In background is one of the mercury-turbine generators

instantaneous peak reached a record high of 3,618,000 kw. Bonneville's maximum output of 2,077,000 kw was maintained through Jan 17 and 18, when demand was highest.

Bonneville was forced to cut off 70,000 kw of interruptible power supplied aluminum plants during peak hours of those two days.

The only other power curtailment occurred in interior British Columbia, where sub-zero weather is causing a threat of power failure in north Okanagan because of the icing water intake at B. C. Power Commission's Shuswap Falls plant. All towns in the area dim out voluntarily every night.

•

Seattle City Light Sets Peak and Output Marks

The worst storm in the history of Seattle on Jan 13 caused Seattle City Light to break two records. When the extreme cold forced people to use electric heaters as an auxiliary source of heat, City Light set a new peak mark of 312,000 kw between 5 and 6 PM. The dark day contributed also to the production record of 4,998,600 kwhr.

In less than a month previous City Light set two peak records. The first of 278,000 kw was on Dec 29, the second of 302,000 kw on Jan 2.

•

Quits Utilities Commission

Robert G. Johnson has resigned from the North Carolina Utilities Commission as of Mar 1, or 11 months before his present six-year term expires.

Output During November Chalks Up New Records

Electric utility production set new records in November. Not only was energy output by electric utilities during that month the highest November production on record, but output for the year ended Nov 30 hit the highest total of any 12-month period to date.

November production totaled 24,328,245,000 kwhr, which was 0.2% above the 24,288,194,000 kwhr produced during October. For the year ended Nov 30 output reached 290,427,498,000 kwhr, 3.5% more than during the year ended Nov 30, 1948, and 0.1% above the previous maximum set during the period ended Sept 30.

Water power plants produced 6,861,226,000 kwhr in November. This was a 4.1% increase over November, 1948. As a percent of November total production hydro output increased from 27.3% in 1948 to 28.2% in 1949. Fuel plants produced 17,467,019,000 kwhr in November.

•

Won't Lease City Plant

The Springfield City Council has rejected an offer by the Central Illinois Light Co to lease the municipal light plant for 20 years at an annual payment of $825,600. The city is badly in need of additional revenue. The two utilities compete in the city. The municipal system serves about 19,000 customers, mostly residential. Central Illinois serves 15,000 but has 90% of the industrial and 70% of the commercial customers.

Detroit Edison Men Win Annual Output Contest

Detroit Edison Co is accepting a second to no one these days. And why should it, since Edison staffers copped first, second, and sixth places in Bob Hatfield's annual kilowatt-hour-output contest.

Delmar D. Chase, assistant superintendent of electric systems, won the latest edition of the guessing match by predicting the total output for 1949 as

DELMAR D. CHASE

290,909,000,000 kwhr. That proved to be less than 0.04% above the actual output, reported at 290,783,000,000 kwhr in this issue of ELECTRICAL WORLD. At that, he barely nosed out Eldred H. Scott, assistant comptroller of Detroit Edison, whose guess of 290,582,000,0000 kwhr, just 0.07% below the correct figure, won him second place. The third representative of the Detroit utility winning an honorary "degree" as "master in the art of load forecasting" was Fred A. Compton, whose sixth place guess was 291,181,000,000 kwhr.

Champ Chase and George Carlisle, vice-president of Railway & Industrial Engineering Co, upheld the honor of the late Office of War Utilities, on which both saw service. Carlisle finished third with a guess of 290,498,000,000 kwhr, just 0.1% off the pace.

Other winners of Hatfield's "degrees," which go to all participants who hit within 0.2% of the correct output, include John F. Sullivan, Commonwealth Edison Co, Chicago, who finished fourth; Donald C. Luce, Public Service Electric & Gas Co, fifth; Miss Rita Meehan, Cleveland Electric Illuminating Co, seventh; and M. J. Urner, Potomac Edison Co, eighth.

Hatfield is an executive of Combustion Engineering-Superheater, Inc.

Pacific Power & Light Sale Hangs in Balance as SEC Opens Hearings

THE SALE OF Pacific Power & Light Co hung in the balance last week as the Securities & Exchange Commission opened hearings in Washington on two bids for the common stock of the Northwest utility.

Actually, only a single purchase offer was under consideration by SEC, a proposal contemplating ultimate sale of much of Pacific's properties to public ownership groups. And the Commission had to deal first with the question of whether or not this transaction, a negotiated deal, should be exempted from competitive bidding requirements of SEC's rule U-50. It was expected to make this decision before the week's close.

A ruling in favor of competitive bidding for disposal of Pacific's stock would throw out both the proposal of a syndicate headed by B. J. Van Ingen & Co and an alternate proposal. The latter, submitted by an investment banking group headed by Allen & Co of New York, will be considered only if the Van Ingen bid is rejected by SEC or is withdrawn.

Van Ingen Offer Amended

Several new developments connected with the Van Ingen group's bid of up to $19.5 million for the stock were revealed as the hearing opened. Spokesmen for this syndicate and for American Power & Light Co, parent holding company of Pacific and owner of its 500,000 shares of common, announced the following details:

1. The Van Ingen group has amended its purchase agreement to guarantee American a minimum return of $14.5 million for the stock. And it will raise this guarantee to $15 million. But the original terms of payment—$10 million in cash, with later payments up to $19.5 million dependent upon later sales of Pacific assets or stock—would stand.

Would Exclude Myers

2. Guy C. Myers, with whom the Van Ingen group has contracted to dispose of Pacific's properties to public utlity districts, would not be allowed to join the underwriting group. Myers previously had been cut in to the extent of an option to buy 12,500 shares of Pacific's common.

In addition, the purchase agreement was amended to prevent Myers from sharing in the proceeds from any resale of Pacific's common. Donald C. Lillis, a partner of one of the firms in the Van Ingen group, asserted that substantial amounts of Pacific's common might be resold by his group. The implication was that much of the company's system might be retained under private ownership.

CURTIS E. CALDER, chairman of the board of Electric Bond & Share Co, parent of American Power & Light Co, was one of the early witnesses at SEC hearings on sale of Pacific P&L. He opposes the Van Ingen offer which Howard Aller, AP&L president, has been strongly supporting

The Van Ingen group, he said, had made no definite commitments for disposal of Pacific's assets or common stock, other than to hire Myers as agent for sales of property to public bodies. Under terms of the group's agreement with American, it must dispose of its holdings in any portions of the Pacific system remaining unliquidated at the end of 18 months.

Herbert Allen, a partner of Allen & Co, described his group's bid of $15 million cash for the Pacific stock as a vote of financial confidence in the operating utility's private management. He referred to the competing offer as a bid of "$10 million, plus a lottery." This remark touched off a heated exchange with representatives of the Van Ingen group.

Among the participants in the proceeding were Raymond W. Clifford of the Washington Public Service Commission; Frank P. Hayes, assistant attorney general of the State of Washington; and J. L. Kennedy, Oregon Public Utilities commissioner. All indicated they would oppose the Van Ingen group offer.

•

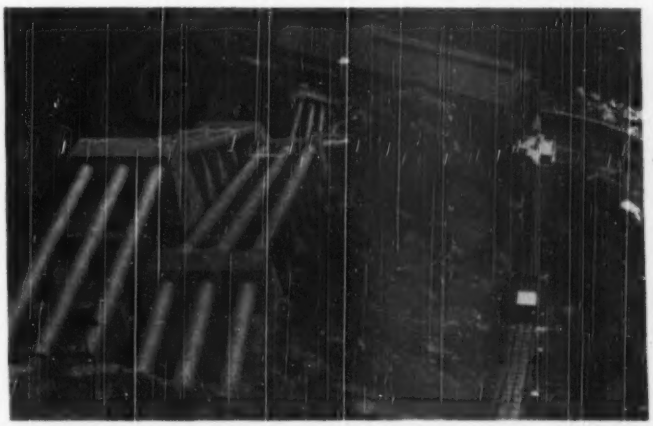
Little Hold on Municipals

Regulatory powers of the Arkansas Public Service Commission are restricted in the case of municipally owned and operated utilities. This is the opinion of the Attorney General's office. However, to make extensions beyond city limits PSC permission is required.

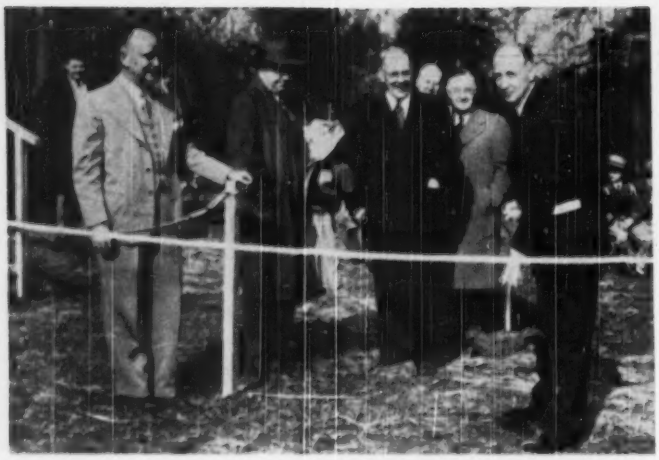
•

To Tax Washington PUD

The Winlock, Wash., City Council has directed the city attorney to prepare an ordinance taxing the Lewis County PUD and other utilities. The tax will raise more than $2,000 annually, city officials estimate.



CLOSED TO SIGHTSEERS DURING THE WAR, historic cable car at Georgia Power Co's Tallulah Gorge hydro plant is back in service. Trip down 1,165-ft incline railway requires 7 minutes. Vertical descent is about 650 ft. Guides are on duty to conduct tours of plant



L. V. SUTTON, president of Carolina Power & Light Co, breaks ground for the Goldsboro Plant. Site is on the banks of the Neuse River. A 100,000-hp steam unit is to go into operation by the middle of 1951, a second a year later, two others when demand requires

Wickard in Fiscal '49 REA Report Defends Loans to 'G&T' Cooperatives

INCREASING RURAL Electrification Administration loans for generation and transmission cooperatives are vigorously defended by REA Administrator Claude R. Wickard in his recently issued report for the fiscal year ended last June 30.

Of a record-breaking total of $448,859,597 in loans approved by REA during the year, $85,000,526 was marked for generation and transmission facilities. The startling fact about this total was that it was more than half the sum approved for "G&T" construction by REA for the entire 13 previous years of the agency's history.

Despite this sharp increase in "G&T" loans—super-co-ops have received an even larger share of REA loan approvals in the months since last June—Administrator Wickard declares, "It is REA's policy to make these loans only where the borrowers cannot otherwise obtain adequate power or where a savings can be effected."

But, he commented, "During 1949 the power-supply situation continued as the principal factor limiting expansion of rural electric lines."

Without mentioning the use of REA funds for facilities to be operated by federal power agencies such as the Southwestern Power Administration, Wickard notes, "Continued construction of large hydroelectric developments promises relief in some areas."

Inadequate transmission capacity was a more serious problem during fiscal '49 than ever before, according to the report.

"Insufficient capacity of transmission facilities of power suppliers was holding back a substantial number of REA borrowers from further development to meet rural needs," the Administrator charged.

From the first federated power co-op —established in Iowa in 1937 "out of the dire necessity for providing power for five distribution cooperatives"—the super co-ops have grown to 20 in number, supplying 14% of the power distributed by REA borrowers.

"They have made it possible to improve service and maintain good service for many more thousands," the report asserted.

Growth of state-wide electric co-op associations to negotiate with utilities is hailed in the report, with assurances of REA help.

"It is hoped that by dealing with suppliers on a statewide basis, they will provide adequate transmission facilities to the co-ops' load centers and reduce the cost of wholesale power at the source," it is suggested.

For fiscal '49, Administrator Wickard claims co-op victory over "threats to co-op ownership." The score: two to one.

Sale of the Malheur Cooperative Electric Association of Vale, Ore., "came only after ten years of co-op efforts to survive in the face of high wholesale power costs and competing lines built by a commercial power company," the report says.

Co-ops Survive Threats

Two co-ops which "successfully turned back the threats" were located in Michigan and Louisiana, it is stated.

Attacking the company offers, Administrator Wickard charges: "In both instances the power companies offered nothing for the members' equity, represented by the portion of loans already repaid; the increased value of the lines since they were built; the value of co-op rights-of-way; and the value of a going business. They proposed merely to take over the co-op's indebtedness to the government. Furthermore, the power company in Louisiana proposed to use the co-op's cash on hand to help pay off the lines."

'49 Saw Great Expansion

Figures in the annual report back Wickard's claim that fiscal '49 "saw the greatest expansion of rural electrification in the history of the Rural Electrification Administration."

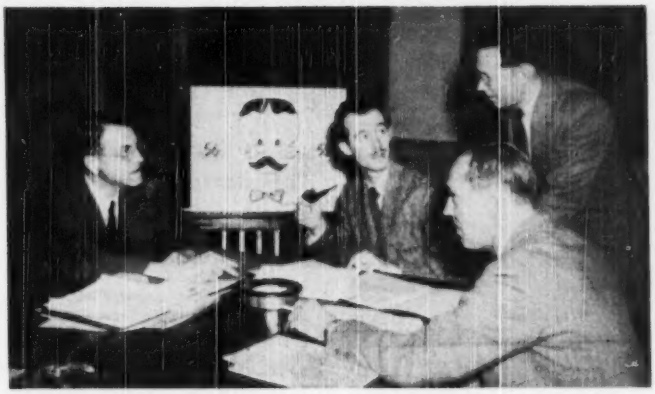
During the last fiscal year, REA advanced $321,286,868, added 514,311 new consumers to lines it financed, and increased energized lines by 173,529 miles. Total loans approved in 14 years reached $1,830,318,858 by last June 30, while consumers were 2,778,180. Since then, loan approvals have passed the $2 billion mark (Jan 10) and consumers are in excess of 3 million.

Financially, REA operations in fiscal '49 continued to show a generally sound position. Payments more than 30 days overdue were $976,145, or 0.5% of the amount of principal and interest due on REA loans. On the other hand, $19,281,894 in payments on principal ahead of schedule were received. During the year, borrowers repaid $22,640,889 of principal and interest of $12,755,748.

REA borrowers during the year generated 829,220,000 kwhr; purchased 5,743,571,000 kwhr; and billed 5,474,002,000 kwhr. Operating revenues were $173,702,495.

Statistical Reprints

Reprints of the Statistical Section of this issue are available at nominal cost upon request to ELECTRICAL WORLD, Editorial Office, 330 W. 42nd Street, New York 18, N. Y.



UNCLE WETHBEE, whose mustached face appears in the background, is now working for Consolidated Edison Co of New York as a weather expert. Uncle not only forecasts the weather but also comments on it very forcefully. The character appears on daily telecasts from WNBT and is drawn before the cameras. George T. Minasian, left, Con Ed, goes over a script with Tex Antoine, Uncle Wethbee's creator and artist narrator, Bayard F. Pope, vice-president, and Cress Pugh, standing, account executive, Batten, Barton, Durstine & Osborn, advertising agency, which handles the Con Ed account

Public and Private Power to Work Together, SPA's Wright Believes

THE BITTER BATTLE over power in the Southwest may be all over but the shouting—at least Administrator Douglas G. Wright of Southwestern Power Administration, indicated in testimony before a Congressional Committee.

Appearing before the Interior Subcommittee of the House Appropriations Committee, Wright said that he

Has reached agreement with two Oklahoma utilities on terms of a "wheeling" agreement,

Is near agreement with seven companies in Missouri, Arkansas, Mississippi, and Louisiana,

Has saved as much as $5-million, perhaps more, in funds appropriated for SPA which will not be expended if the new agreements are approved by the Department of the Interior.

Interior has found "very serious defects" in the Oklahoma contracts, Wright admitted, but he expressed confidence that they could be ironed out in further negotiations with the companies, Public Service Co of Oklahoma and Oklahoma Gas & Electric Co.

Agreement as to form and content for a contract has been reached with the seven-company group, the SPA administrator disclosed. He predicted quick agreement. The companies are Arkansas Power & Light, Louisiana Power & Light, Mississippi Power & Light, Southwestern Gas & Electric, Gulf States Utilities, Arkansas Missouri Power, and Missouri Utilities.

Savings from SPA-company contracts will be at least $5 million.

Describing the terms of the new agreements as "about three times as good" as SPA's contract with Texas Power & Light Co, Wright declared: "I know of nothing in the wording of the contract whereby in my judgment the government could ask the companies to do anything more except go bankrupt."

Provisions of the Oklahoma agreement call for the companies to deliver power to federal customers. Companies agree to cancel their contracts with any customers whom the government wants to serve. In the case of towns or private customers whom the company has served within the last two years before the government decides to serve them, the government will pay the companies for the power they deliver to those customers the wholesale rate set for the company by the regulatory body applicable to the class of service rendered.

Where delivery of Federal power requires new line, the company may deliver the power to the nearest point on its system so that the government will have a minimum of line to build.

Under the contract, SPA and the companies will review rates each third year. Failure to reach agreement cancels the contract.

If the proposed contract with the Oklahoma companies is executed and made to work, Wright told the Congressional committee, "The power industry for the first time will be operating under arrangements whereby the government and private industry cooperate in carrying out the mandates of Congress in regard to the transmission and distribution of surplus electric power and energy generated at flood control projects."

In addition to the contract agreements with the companies, Wright told the Committee that SPA has reached agreement with six REA-financed generation and transmission cooperatives for the use of new facilities.

The co-ops are M. & A. Electric Power Cooperative in Missouri and Arkansas; Western Electric Cooperative, Oklahoma; Arkansas Electric Power Cooperative, Arkansas; N. W. Electric Power Cooperative, Inc., and Central Electric Power Cooperative, both in Missouri; and Brazos River Transmission Electric Cooperative, Texas. M. & A. and Brazos will buy federal power for sale to their members, while SPA will lease and operate transmission facilities under arrangements with the other four groups. Further, Wright disclosed that contracts have been signed for the sale of power to a total of nine other power co-ops and six municipal systems. Negotiations are underway with five other cooperatives and three other municipalities.

•

Energy Tax to Stay

No chance for repeal of the tax on electrical energy seems likely at this session of Congress. The energy tax was not mentioned in President Truman's Jan 23 tax message to Congress, and no Congressional drive for repeal has developed. Although not mentioned specifically in the Presidential message, taxes on light bulbs, radios, and electrical appliances appear to have brighter repeal possibilities.

•

Iowa Can't Block Co-op

A plea of the State of Iowa to have the order of the Federal Power Commission granting the First Iowa Hydro-Electric Cooperative permission to construct a plant on the Cedar River has been denied by the U. S. Court of Appeals. The State contended the project is not economically feasible. The court said that FPC had sole responsibility for determining this.

Middle West Files Plan to Liquidate in 2 Years

Middle West Corp has filed a plan with Securities and Exchange Commission for the divestment of its securities and assets and its own liquidation.

SEC had ordered the holding company to divest itself of certain "nonretainable" assets in 1944. The directors and stockholders voted to dissolve as well.

Middle West, which holds the remains of the Insull interests, now is valued at about $10 million. At one time it was the top company for a system serving 800,000 customers in 15 states, Canada, and Mexico, with assets valued at $451 million. The eleven holding companies and 56 operating companies included electric and gas utilities, water supply systems, rail and bus companies, steam heating firms, ice plants, and real estate holdings.

Since issuance of the Commission's order Middle West has disposed of substantially all its holdings. As of Dec 31 it retained an interest in only two companies, Upper Peninsula Power Co and Sand Springs (Okla) Water Co.

Under the present plan the sum of $2.25 in cash would be paid for each of the 3,294,871 outstanding shares of Middle West's $5-par capital stock upon surrender of the stock for cancellation.

Middle West also has outstanding scrip certificates exchangeable for 11,257 shares of common stock; receivers' receipts, issued by the receivers or the trustee of the predecessor Middle West Utilities Co in reorganization proceedings, against which 545.02 shares of Middle West stock are issuable; and certificates of deposit, against which 561.42 shares are issuable. Distribution of these will be made at the rate of $2.25 a share.

Middle West's remaining assets then will be reduced to cash and all liabilities discharged. As soon as practicable after Dec 31, 1951, all remaining assets will be distributed and paid out pro rata to holders of the stock, scrip certificates, receivers' receipts, and certificates of deposits.

•

Selling Canadian Utility

All the capital stock of Middle West Utilities Co of Canada is being sold for approximately $7.5 million cash to Great Lakes Power Co.

Middle West Utilities was sold to an investment firm last month by Middle West Corp, a Chicago holding company. Control of Great Lakes Power recently was acquired by a Canadian group including J. A. McPhail, president of both utilities. Before the sale Middle West Utilities will pay a cash dividend of $1,250,000.

FINANCIAL BRIEFS

Continental Gas & Electric Corp plans to buy an additional 270,000 shares of the $10-par common stock of Iowa Power & Light Co. The necessary funds will be provided by a capital contribution from Continental's parent, United Light & Railways Co.

Pacific Gas & Electric Co has acquired full control of Vallejo Electric Light & Power Co with the purchase of the remainder of the latter's outstanding stock. Pacific had owned a 45.8% interest since 1929. VEL&P serves about 13,500 customers.

Bids will be opened Feb 6 on $15 million in Seattle Municipal Light & Power System bonds. Proceeds will be used to finance construction of hydroelectric generating facilities on the Skagit River. Another $485,000 in municipal light bonds also is being issued.

A by-law providing for issue of $38,000 in debentures to purchase the distribution system of Rideau Power Co, Ltd, has been placed before voters of Merrickville, Ontario, for decision Jan 30.

Westinghouse Electric Corp has called for Feb 1 redemption its 79,974 outstanding shares of Series A preferred stock. Price will be $104 plus accrued dividends to Feb 1.

Corporation bank borrowing was recently given a new twist in the form of competitive bidding among the banks for a term loan to a public utility. Bankers said they believed it was the first time such an approach to bank borrowing had been tried. Reportedly the lowest interest rate offered on a $14-million five-year loan to Consolidated Natural Gas Co was 2%, the lowest rate offered on a five-year loan since the downturn in interest rates started early in 1949.

Cumberland Public Service Co, Burksville, Ky., did not use liquidation proceedings in 1940 to avoid paying an income tax, the Supreme Court has ruled. The case involved sale at $104,000 of some Cumberland property to Tri-County Electric Membership Corp by two stockholders after liquidation of the utility. The Internal Revenue Bureau, making its computations on the basis that the corporation itself had made the sale, found a tax deficiency for 1940 of $17,000. Payment was made under protest.

•

Plan of United Railways, Continental OK'ed by SEC

The amended plan for liquidation and dissolution of United Light & Railways Co and Continental Gas & Electric Corp has been approved by Securities and Exchange Commission.

In general the plan provides for payment of the outstanding bank loans of Railways and Continental, the distribution among or sale to their stockholders of the common stocks of four operating utility subsidiaries, and the dissolution of the two holding companies.

Continental will be liquidated first. Public holders of 14% of its common stock will receive 2.745 shares of Kansas City (Mo.) Power & Light Co common, 1.830 shares of Iowa Power & Light Co (Des Moines) common, and 457.5 shares of St. Joseph (Mo.) Light & Power Co common. Continental will sell or otherwise dispose of certain of its investments other than the stocks of the three operating companies. Then its remaining assets will be transferred to Railways, which will assume Continental's bank loan and other liabilities.

Stockholders of Railways will share in the distribution of its holdings as follows: The 317,792 common shares of St. Joseph on a 1 for 10 basis, the 1,588,499 shares of Iowa Power & Light common on a 1 for 2 basis; and the 1,904,003 shares of common stock of Iowa-Illinois Gas & Electric Co, Des Moines, at 3 for 5. The 1,906,748 shares of Kansas City P&L common will be offered for subscription by Railways' common stockholders at 3 for 5.

•

C. B. McManus Elected President of Southern Co

Clifford B. McManus has been elected president of Southern Co to succeed E. A. Yates, who becomes chairman of the board. McManus will continue as president of Georgia Power Co, Southern Co subsidiary.

McManus was with Westinghouse Electric Corp, General Electric Co, and Alabama Power Co before joining Georgia Power in 1927. With the latter utility he has been superintendent of district operations, assistant operating manager, assistant to the president, vice-president and director of operations, and, since 1947, president.

Coast Cold Wave Pushes Output to Another Record

Another output record tumbled the week ended Jan 21, when the nation's electric light and power companies distributed 6,041,158,000 kwhr.

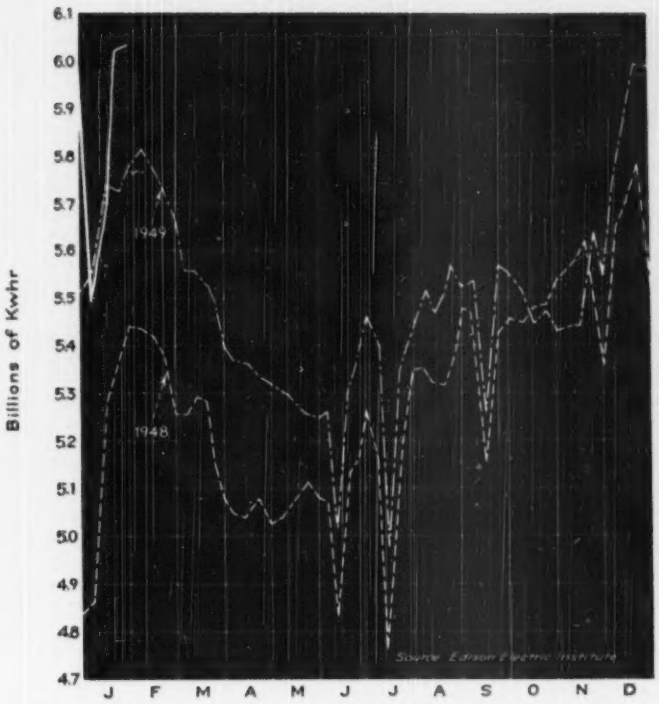
The previous record was set the week ended Jan 14, with 6,028,589,000 kwhr distributed. Output for the week ended Jan 21 was 4.7% above that for the corresponding week a year ago, 5,768,934,000 kwhr. A major factor in the zooming output figures was the cold wave on the Pacific Coast.

Weekly Output, Millions Kwhr

1950		1949		1948	
Jan 21	6,041	Jan 22	5,769	Jan 24	5,436
Jan 14	6,029	Jan 15	5,727	Jan 17	5,370
Jan 7	5,695	Jan 8	5,742	Jan 10	5,278
1949		1949		1948	
Dec 31	5,493	Jan 1	5,562	Jan 3	4,868
1949		1948		1947	
Dec 24	5,994	Dec 25	5,508	Dec 27	4,826
Dec 17	5,997	Dec 18	5,790	Dec 20	5,368
Dec 10	5,881	Dec 11	5,705	Dec 13	5,327
Dec 3	5,743	Dec 4	5,646	Dec 6	5,218
Nov 26	5,537	Nov 27	5,349	Nov 29	4,983
Nov 19	5,644	Nov 20	5,627	Nov 22	5,180

Percent Change from Previous Year

	Jan 21	Jan 14	Jan 7
New England	+ 7.0	+ 8.8	+ 0.4
Mid-Atlantic	+ 1.0	+ 1.9	— 6.0
Central Industrial	+ 2.4	+ 2.2	— 3.7
West Central	+ 7.3	+10.9	+ 2.9
Southeast	+ 6.6	+ 4.5	+ 1.6
South Central	+ 8.6	+ 8.9	+ 4.7
Rocky Mountain	+ 2.7	+ 0.4	0.6
Pacific Coast	+ 8.7	+13.4	+ 4.6
Total United States	+ 4.7	+ 5.3	— 0.8



MEETINGS

American Institute of Electrical Engineers
Winter General Meeting, Hotel Statler, New York, N. Y., January 30-February 3; Power Conference sponsored by Committees on Power Generation, Industrial Power Systems, and System Planning, William Penn Hotel, Pittsburgh, Pa., I. Power Generation, April 19, II. Industrial Power Systems, April 20.

Missouri Valley Electric Association
Power Sales Conference, President Hotel, Kansas City, Mo., February 9-10; Engineering Conference, President Hotel, Kansas City, Mo., March 29-31.

Edison Electric Institute
System Operations Committee, Roosevelt Hotel, Pittsburgh, Pa., February 9-10; Accident Prevention Committee, Shamrock Hotel, Houston, Tex., February 9-10; Electrical Equipment Committee, Netherlands-Plaza Hotel, Cincinnati, Ohio, February 13-14; Industrial Relations Committee, Palmer House, Chicago, Ill., February 16; Transmission and Distribution Committee, Statler Hotel, Detroit, Mich., February 20-21; Industrial Relations Committee, EEI headquarters, New York, N. Y., March 16; Netherlands-Plaza Hotel, Cincinnati, Ohio, April 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 4-6; Purchasing and Stores Committee, Schroeder Hotel, Milwaukee, Wis., April 24-26.

Pennsylvania Electric Association
Transmission and Distribution Committee, Penn-Harris Hotel, Harrisburg, Pa., February 16-17; Joint Midwinter Meeting, Electrical Equipment Committee and Prime Movers Committee, Robert Treat Hotel, Newark, N. J., February 23-24.

National Adequate Wiring Bureau
Adequate Wiring Conference, Statler Hotel, St. Louis, Mo., February 16 and 17.

American Society for Testing Materials
Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Pa., February 27-March 3.

National Rural Electric Cooperative Association
Annual Convention, Hotel Stevens, Chicago, Ill., March 6-9.

National Electrical Manufacturers Association
Edgewater Beach Hotel, Chicago, Ill., March 13-16.

Conference for Protective Relay Engineers
Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, Tex., March 20-22.

Southeastern Electric Exchange
Engineering and Operating Section, Buena Vista Hotel, Biloxi, Miss., March 23-24; Annual Conference, Greenbrier Hotel, White Sulphur Springs, W. Va., April 12-14.

American Public Power Association
Annual Convention, Shoreham Hotel, Washington, D. C., March 28-30.

National Association of Purchasing Agents
Annual Midwinter Conference, Hotel Statler, Detroit, Mich., February 13-14.

Midwest Power Conference
Sherman Hotel, Chicago, Ill., April 5-7.

American Society of Mechanical Engineers
Spring Meeting, Hotel Statler, Washington, D. C., April 12-14.

* **Northwest Public Power Association**
Semi-annual Convention, Davenport Hotel, Spokane, Wash., April 17-19.

* **Electrochemical Society**
Annual Convention, Statler Hotel, Cleveland, Ohio, April 19-22.

* **Oklahoma Utilities Association**
Annual Convention, Biltmore Hotel, Oklahoma City, Okla., May 4-5.

* **Additions This Week**

Utilities Using More Fuel Oil, Less Gas and Coal

Use of oil as a fuel for electric generating plants is soaring. November use of 7,316,302 bbl was the highest of any month in history. It was 104.9% higher than in November, 1948, and 9.9% higher than the previous record set in October, 1949.

Use of coal in November, 1949, was 6,707,873 tons, 22% less than in the corresponding month a year earlier when consumption was 8,600,353. But November use was slightly greater than the 6,569,357 tons used in October.

The use of gas, 46,937,719,000 cf, was the highest November consumption of record but was 15.2% less than in October, 1949.

Based upon the November rate of consumption, coal stocks on hand at electric utility plants on Dec 1 were sufficient to last 102 days, compared with 113 days a month earlier and 96 days a year ago.

•

Will Sell Municipal

Taxpayers of Wolfville, N. S., have voted to sell the municipal system to the Avon River Power Co, Windsor.

WASHINGTON COMMENT

RONALD D. ROSS

FAIR DEAL PLANNING to bring New England "the benefits of large-scale public power development," as proposed in President Truman's State of the Union message, is beginning to take shape.

It's no surprise that Assistant Secretary of Interior C. Girard Davidson thus far has been the chief tactician for the budding campaign to sell the public power idea to the people of New England. For some time Davidson has been a leading public power spokesman for the Truman Administration. But some of the points in his New England sales talk are fresh, if not exactly surprising.

To start, while critics have been blasting the proposed New England development as advanced federal paternalism, Davidson frankly admitted the program would be part and parcel of a welfare state. In a recent Springfield, Mass., discussion he asserted that the Democrats "are not afraid of the welfare state; we are proud of it." Only subsequent elections, however, will establish whether or not New England's Democrats really want the welfare state, complete with public power attachments.

At the same time, Davidson revealed the Administration has endorsed legislation recently proposed by Sen Theodore Francis Green of Rhode Island. The Green Bill would authorize a five-man New England River Basin Study Commission. It would study "the whole region, not just pieces of it," and "all possible uses of rivers, not only for water power."

The Commission, to be appointed by the President, would be made up of representatives of the Army, Interior, and Agriculture Departments and the Federal Power Commission, plus a non-federal-government member from New England. It would be assisted by an advisory committee composed of one representative to be selected by each of the governors of the six New England states.

Within two years the Commission would prepare a "basic, comprehensive plan for the development of the water and land resources" of the region. Such a plan apparently would then become the blueprint of an Administration program "for meeting some of the basic problems of New England." In other words, New England's share of welfare from the welfare state.

Davidson did not go so far as to predict the form of federal developmental organization best suited to carry out such a program. That probably will constitute one of the Commission's recommendations. Meanwhile, there is unofficial talk in public power circles of a possible New England Valley Authority and of some less elaborate type of federal administrative device. On this score Davidson merely pointed to both TVA and the Interior Department's Southwestern Power Administration as organizations which New England might well desire to duplicate.

One thing is certain. Regardless of the engineering and other details to be developed, the program must soon fall heir to a title in the interests of modern political requirements. Even the Truman Administration would be hard pressed to win Yankee enthusiasm for anything as vague as a "New England River Basin Survey Commission." The Commission simply has no political "oomph," representing only the hopes for a dynamic program. And elections are coming up this fall.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Augers are available to dig the large diameter holes required for tower footings and they can be tilted to the proper base angle.

Stainless steel transmission crossarms are being considered by a utility for districts subjected to badly corrosive atmospheres.

Soft metals can be welded cold without flux or solder by a patented process in which the joined parts are compressed by a tool that deforms to result in merging flow of the contact surfaces.

Aluminum sheath is being used increasingly for communication cables. For power cables the technical problem is one of extrusion or possibly the new cold-welding technique.

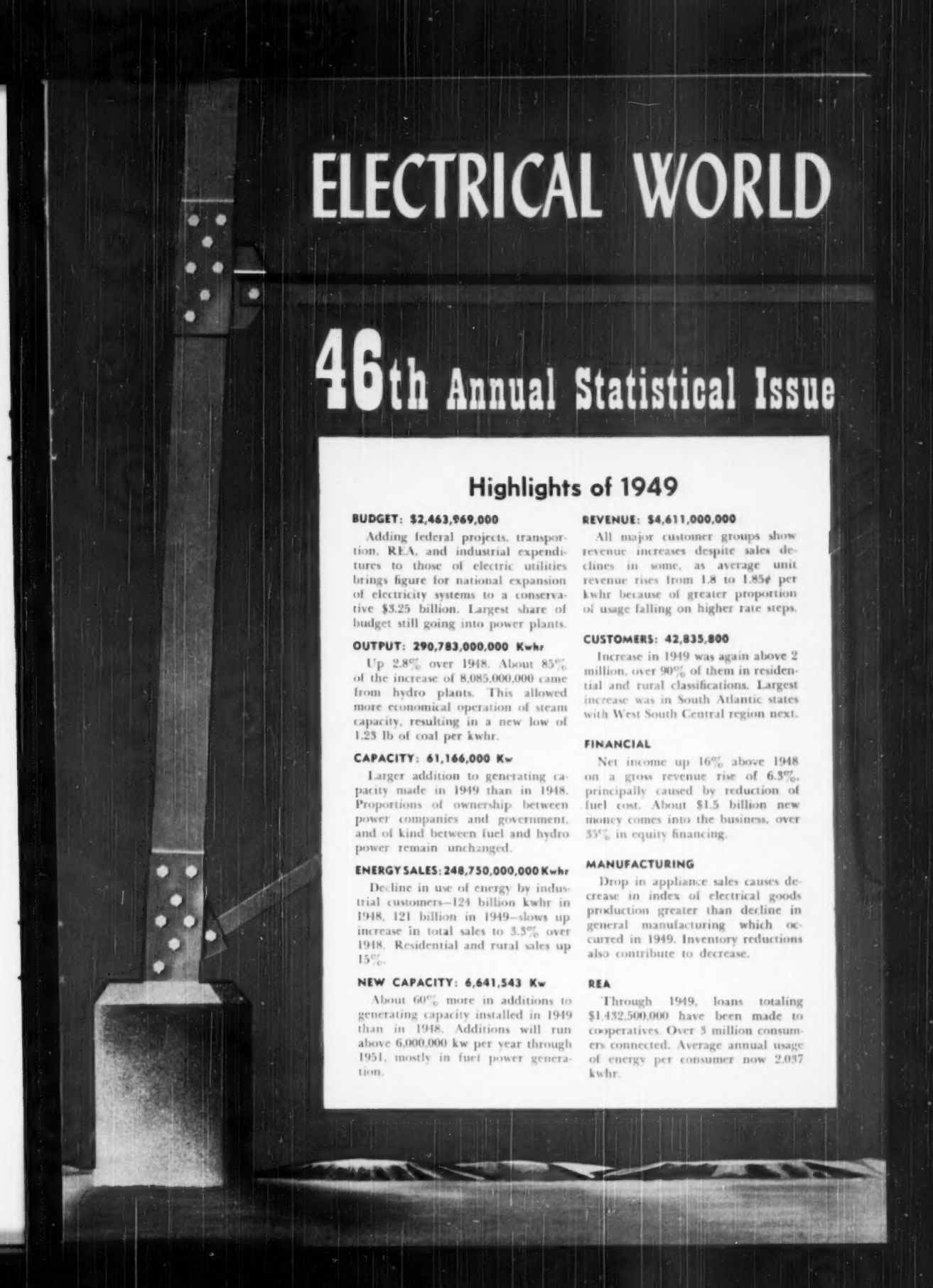
Meter testing periods of 8 years are no more sacrosanct against lengthening to 10 or even 12 years than the old 8% return on investment was proofed against commission paring. Experience and technology grow as well as loose money.

Regenerative and recuperative heaters are being redesigned to minimize (1) corrosion, (2) fouling rate, (3) time to clean and (4) time to repair.

Adjustable-speed couplings on fan and pump drives should generally be accompanied by indicating tachometers.

Interfacial tension tests on transformer oil is lowered (sometimes 75%) by sludging and oxidation but unfortunately small quantities of contaminating substances have the same result even when a nitrogen blanket prevents oxidation.

Higher-voltage metering is confronting more and more of the smaller utilities. The know-how is often a bit intricate and deserves study and preparation.



ELECTRICAL WORLD

46th Annual Statistical Issue

Highlights of 1949

BUDGET: $2,463,969,000

Adding federal projects, transportion, REA, and industrial expenditures to those of electric utilities brings figure for national expansion of electricity systems to a conservative $3.25 billion. Largest share of budget still going into power plants.

OUTPUT: 290,783,000,000 Kwhr

Up 2.8% over 1948. About 85% of the increase of 8,085,000,000 came from hydro plants. This allowed more economical operation of steam capacity, resulting in a new low of 1.23 lb of coal per kwhr.

CAPACITY: 61,166,000 Kw

Larger addition to generating capacity made in 1949 than in 1948. Proportions of ownership between power companies and government, and of kind between fuel and hydro power remain unchanged.

ENERGY SALES: 248,750,000,000 Kwhr

Decline in use of energy by industrial customers—124 billion kwhr in 1948, 121 billion in 1949—slows up increase in total sales to 3.3% over 1948. Residential and rural sales up 15%.

NEW CAPACITY: 6,641,543 Kw

About 60% more in additions to generating capacity installed in 1949 than in 1948. Additions will run above 6,000,000 kw per year through 1951, mostly in fuel power generation.

REVENUE: $4,611,000,000

All major customer groups show revenue increases despite sales declines in some, as average unit revenue rises from 1.8 to 1.85¢ per kwhr because of greater proportion of usage falling on higher rate steps.

CUSTOMERS: 42,835,800

Increase in 1949 was again above 2 million, over 90% of them in residential and rural classifications. Largest increase was in South Atlantic states with West South Central region next.

FINANCIAL

Net income up 16% above 1948 on a gross revenue rise of 6.3%, principally caused by reduction of fuel cost. About $1.5 billion new money comes into the business, over 35% in equity financing.

MANUFACTURING

Drop in appliance sales causes decrease in index of electrical goods production greater than decline in general manufacturing which occurred in 1949. Inventory reductions also contribute to decrease.

REA

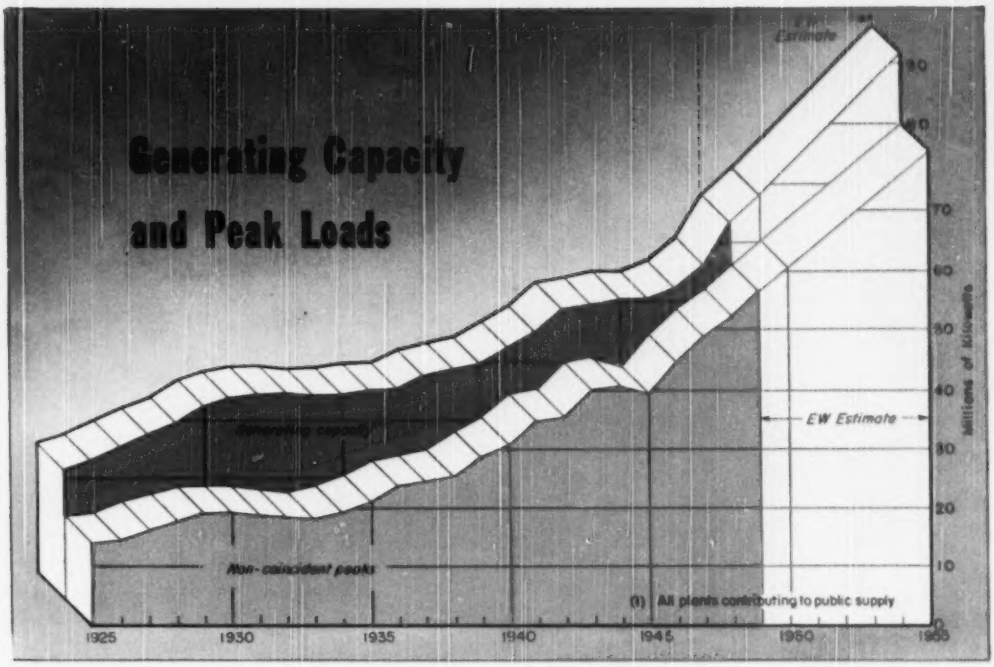
Through 1949, loans totaling $1,432,500,000 have been made to cooperatives. Over 3 million consumers connected. Average annual usage of energy per consumer now 2,037 kwhr.

Outstanding Facts

The Statistics Summarized

	1942	1943	1944	1945	1946	1947	1948	1949*
FINANCIAL[1]								
Fixed Capital ($1,000,000)	13,053	13,022	12,956	12,667	13,111	14,065	15,713	17,455
Securities issued[2] ($1,000,000)	356	371	1,018	1,362	1,082	1,577	1,451	1,793
New capital	93	10	16	40	173	568	1,314	1,445
Refunding	264	361	1,003	1,322	910	1,010	136	348
INCOME and OUTGO[1] **($1,000,000)**								
Operating revenue	2,609	2,816	2,955	3,012	3,127	3,480	3,903	4,150
Operating expenses	1,002	1,127	1,225	1,259	1,385	1,701	2,026	2,030
Taxes	628	680	677	652	639	664	716	810
EXPENDITURES ($1,000,000)[3]								
Capital	456	306	340	409	718	1,372	2,078	2,518
REVENUE[1] **($1,000,000)**								
Total from customers	2,886	3,078	3,277	3,342	3,460	3,853	4,313	4,611
Rural[2]	75	77	83	90	105	124	141	160
Residential	990	1,029	1,098	1,167	1,241	1,366	1,533	1,720
Small Light and Power	767	774	817	850	925	1,031	1,153	1,220
Large Light and Power	828	964	1,043	1,002	969	1,107	1,251	1,265
Other consumers	196	234	236	233	220	225	237	264
ENERGY SALES[1] **(1,000,000 kwhr)**								
Total to consumers	159,408	185,889	198,161	193,558	190,794	217,581	240,740	248,750
Rural[2]	2,890	2,996	3,373	3,668	4,431	5,551	6,327	7,425
Residential	26,937	28,621	31,266	34,184	38,571	44,171	50,978	58,500
Small Light and Power	27,234	29,071	29,837	30,438	33,016	38,379	43,193	46,125
Large Light and Power	88,378	105,778	115,187	107,490	98,885	113,523	124,088	120,750
Other	13,968	19,423	18,498	17,778	15,891	15,957	16,154	15,950
OUTPUT (1,000,000 kwhr)								
Generated	185,979	217,759	228,189	222,486	223,130	255,739	282,698	290,783
From fuel	122,108	144,127	154,244	142,516	144,733	177,314	200,228	201,525
From water power	63,871	73,632	73,945	79,970	78,397	78,425	82,470	89,285
CAPACITY (1,000 kw)								
Total generator ratings	45,053	47,951	49,189	50,111	50,317	52,322	56,560	61,166
Fuel	32,211	34,067	34,603	35,199	35,468	37,351	40,908	44,775
Hydro	12,482	13,884	14,586	14,912	14,849	14,971	15,652	16,391
FUEL CONSUMPTION[1]								
Coal (1,000 short tons)	66,260	77,300	80,080	74,720	72,200	89,530	99,950	87,300
Oil (1,000 bbl)	15,240	17,990	20,860	20,230	36,320	45,310	42,640	58,950
Gas (billion cu ft)	235	302	359	326	307	373	478	539
Pounds of coal per kwhr	1.30	1.30	1.29	1.30	1.29	1.31	1.30	1.23
CUSTOMERS (1,000)								
Total number	32,210	32,396	33,048	34,031	36,140	38,432	40,722	42,836
Rural[2]	1,096	1,088	1,144	1,234	1,381	1,522	1,695	1,816
Residential	26,620	26,872	27,371	28,117	29,769	31,622	33,549	35,356
Small Light and Power	4,219	4,168	4,263	4,398	4,693	4,961	5,132	5,284
Large Light and Power	150	147	153	162	175	191	204	232
Other	125	121	118	120	122	136	142	148
People in homes served (1,000)	104,882	105,000	107,000	110,000	115,000	123,000	130,000	137,500
Percent of total civil population	77.4	77.3	80.0	81	82	86	89	93
EMPLOYEES[1]**, total (1,000)**	221	205	200	222	252	269	283	291

* Estimated, generally on ten months' operation. [1] Power companies only. [2] Covers power companies, municipal utilities, and state authorities, but not REA cooperatives or federal projects. [3] On specific rural rates only.



IN FIVE YEARS non-coincident peak on all systems contributing to the public supply is estimated to rise 41% and capacity 45%

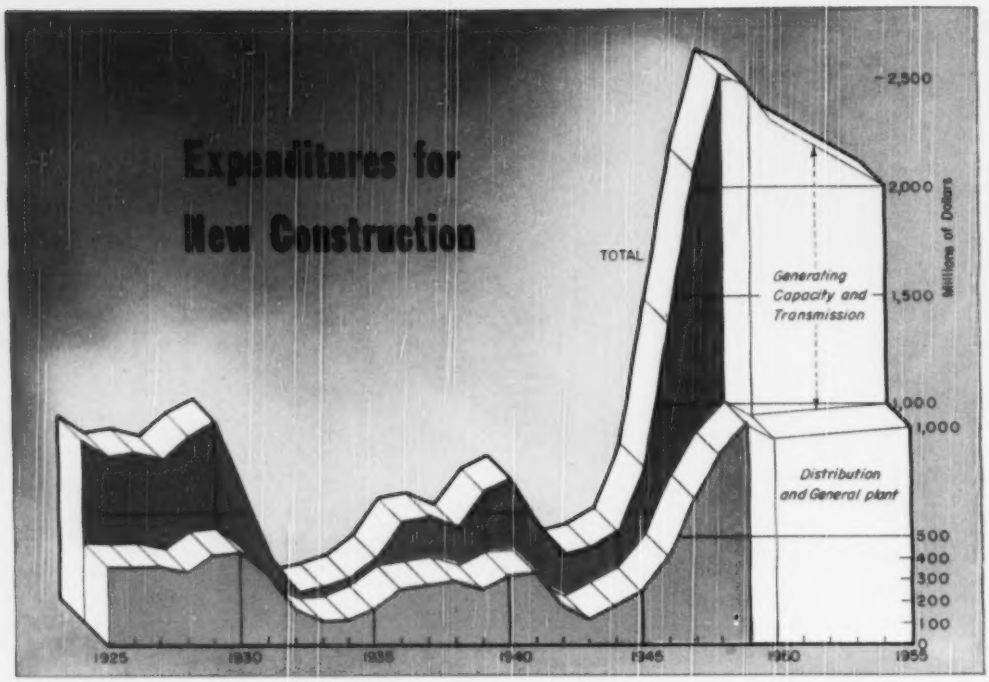
A Look Ahead

Load will rise faster than energy sales. Financing outlook is good

INSTALLED capacity and non-coincident peak loads of all electric systems contributing to the public supply are expected to reach a total of 92 million kw of capacity and 80 million kw in peak by 1955. This represents a predicted gain of 45% in capacity and 41% in peak for the six-year period. Beginning with a reserve of 12% in 1949, it is assumed that an average of 15% will prevail in 1955. Predictions of the Electric Power Survey Committee of the EEI show reserves averaging nearer 20%.

The electric output is only expected to rise 36% to a total of 396 billion kwh by 1955. Obviously the lower gain in energy use compared with increase in peak represents a reduction in load factor to 56% in 1955. In the history of the industry before the war, load factor only once reached as high as 55%. That was in 1937. During the war it went to 64.2%. In 1948 it was 59.9%, and in 1949 was 58.4%. In the 22 years before the war, the load factor range was from 48.2% to 55%, with most percentages falling closer to 50 than to 55.

The results of industry load growth in 1949 produce a muddled picture. While residential and farm use went up 15% and small light and power gained 7%, large light and power use decreased 2.5%. However, for the next five years it is predicted that the residential and farm use will average an increase of 8%, small light and power 6%, and large light and power 5%. These estimates for future growth of the industry are based upon the maintenance of a satisfactory level of business activity throughout the entire period. Such rates of growth are substantiated by the industry's own predictions through 1952; the outlook for



GENERATING PLANT and transmission line expansion will probably slacken off in a couple of years as satisfactory margin of capacity reserve is built up. But total construction outlays will be kept at a high level by continuing additions to distribution facilities. This graph does not include construction expenditures which were made by REA cooperatives and federal agencies

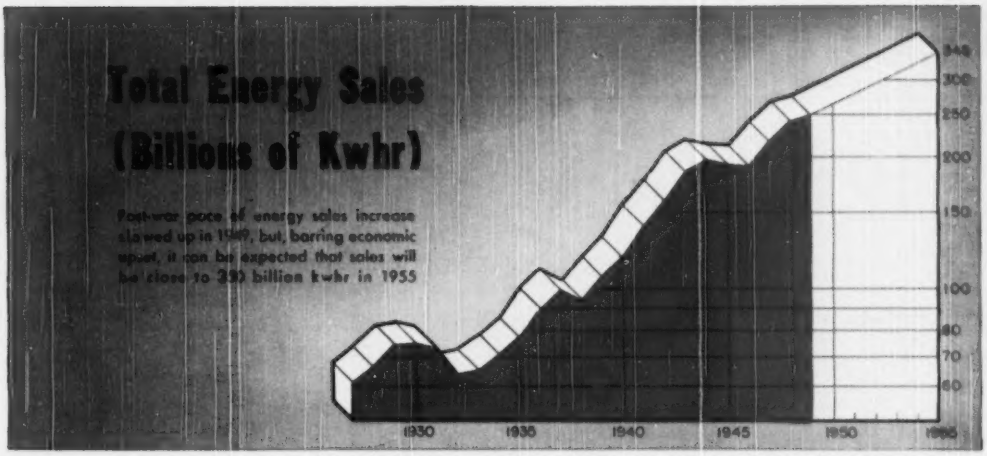
new home construction, appliance sales, farm use; commercial lighting, air conditioning and electric cooking facilities; and continued expansion in the use of labor saving devices in industry, electric heating and processing equipment, and municipal facilities of all types.

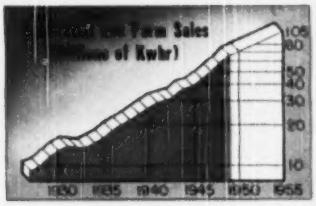
Evidence of the continuing high rate of capacity increase also appears in the accompanying table of steam and hydro capacity delivered in 1949 and on order through 1952 as reported by the major manufacturers of such equipment. Paralleling these data are figures of capacity installed in 1949 and planned for installation through 1952 by utilities. The two groups of data do not agree item by item, but they do unite in saying that over 15 million kw of capacity will be added in the next three years. An additional 15 will be required by 1955 without consideration for the retirement of all essential equipment.

It is probable that the peak year of capital expenditure in the current expansion period will turn out to be 1950. For 1949 the private companies and municipals, including TVA, spent a total of $2.5 billion, electric co-ops $300 million, Corps of Engineers $227 million and U. S. Bureau of Reclamation $69 million, totaling $3.1 billion. Due to the stepping up of federal programs along with a continuation of the utility expansion at about the same rate, it appears that the construction expenditures will run near $3.3 billion in 1950.

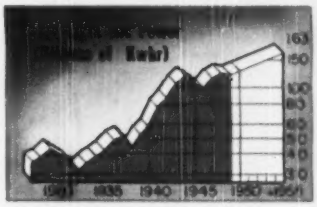
Generating Capacity Additions
(1,000 kw)

	Delivered and On Order for Delivery			Installed and Planned to be Installed		
During	Steam	Hydro	Total	Steam	Hydro	Total
1949	5,038	1,750	6,788	5,389	1,201	6,590
1950	5,611	1,201	6,812	5,098	1,118	6,216
1951	4,206	1,266	5,472	4,293	1,457	5,750
1952	1,130	916	2,046	2,971	1,306	5,277
Totals	15,985	5,133	21,118	17,751	5,082	23,833

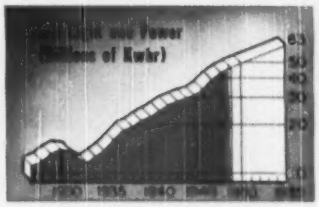

Total Energy Sales
(Billions of Kwhr)
Post-war pace of energy sales increase slowed up in 1949, but, barring economic upset, it can be expected that sales will be close to 350 billion kwhr in 1955
1930
1935
1940
1945
1950



RESIDENTIAL and farm sales estimated to grow 8% per year during the next six years



INDUSTRIAL use of energy fluctuates with business; is estimated to grow 5% yearly



SALES to commercial customers rise continuously at a rate of about 6%

After 1950 a tapering off of expenditures is expected. Since federal agencies depend upon appropriations, they have not been included in the chart Expenditures for New Construction. Were they included on the basis of predicted generating capacity additions, they would tend to cause a leveling off at a point very little under the present rate of capital expenditures.

In 1949, new capital raised by power companies amounted to $1,445 million. Gross corporate income rose to $1,050 million from $914 million in 1948, an increase of $136 million in earnings available for interest, dividends and surplus. This is a return of 9.4% on the new capital. But 1949 was an exceptional year; unusually large hydro production and opportunity to realize on the higher efficiency of new capacity caused a drop to 49.9% in operating ratio from 52.7% in 1948.

Assuming that stock sales in 1949 included no refunding, equity securities issued in the year were 44.4% of new capital. This closely approaches the optimum 50-50 ratio of equity to debt and may be taken as a good augury for the future.

There is ample evidence that in the next six years the electric light and power industry can weather any probable economic storm. Earnings can be maintained through the improvements in operating efficiency along with active selling campaigns. Any failure to carry out these two management responsibilities would upset the potential goal. Gains in the field of reduced capital outlays per unit of consumer demand have been most satisfactory. Even though many unit costs have doubled, power plant expenditures have been held down by refinements in design. Since most systems have covered their service area to a substantial degree, new loads can be added at a minimum of capital outlay.

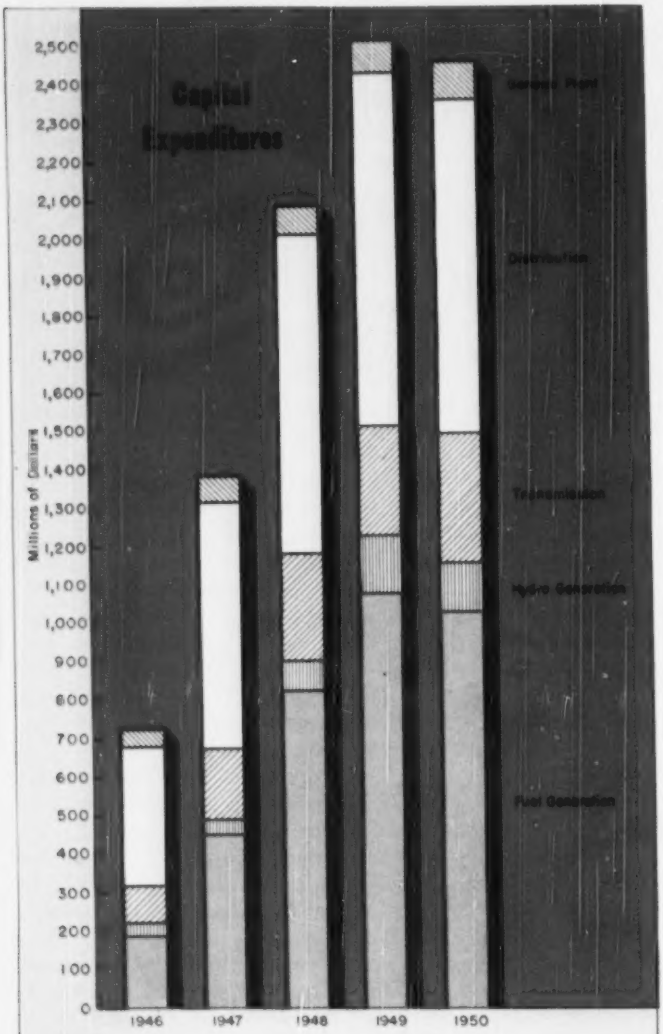
The potential growth in power loads in the field of house heating and cooking and farm uses is yet to be determined. If the industry concentrates attention on the economic and engineering aspects of such equipment, present estimates of consumer demand may well be far below the actual demand.

With these basis trends in mind, the outlook is excellent for progress and growth.

Budget
$2,463,969,000

1950 Budget Equals 1949

Power plants still taking major share of capital expenditures



SPEED of post-war expansion of their systems by electric utilities is shown by the rapid heightening of these bars, 1946-1949. This year, construction will continue at 1949's pace

WELL OVER $3.25 billion will probably be expended in construction facilities for electricity supply in this country next year. The base figure for this guess is the nearly $2.5 billion detailed on these pages as the 1950 capital expenditure of power companies and municipal and other local government utilities, including the Tennessee Valley Authority. To this is added estimated capital outlays by the Bureau of Reclamation, $117.5 million; by the Army Engineers, $323.8 million*; by REA cooperatives, $326.6 million.** Another addition must be made to cover expenditures by industrial plants and by transportation systems. The amount of this addition is indeterminable, but certainly it will be enough to bring the total 1950 outlay for electricity supply facilities "well over $3.25 billion."

Last year at this time, ELECTRICAL WORLD estimated that electric utilities would spend $2,365,340,000 on new construction in 1949. Actually, according

* Army Engineers reported $227 million for fiscal 1950 and $420.5 million for fiscal 1951. Since these fiscal years begin July 1, 1949 and 1950, the figure for calendar 1950 was taken as the average of them.

** No close estimate of 1950 expenditures by REA cooperatives is available. For the purpose here, it was assumed that funds advanced in 1950 would be the same as in 1949. This amount was taken as the 1950 outlay.

to present reports, they did spend $2,517,640,000, about 6.5% more. With this in mind, it would be unsafe to say that 1949 was the peak year of electric utility capital expenditure. The estimate for 1950, $2,463,969,000, is only 2% under 1949. The end of the year may show 1950 above 1949. Such speculation aside, it can be said that if present plans are carried out, electric utility construction will proceed at the same rate this year as last.

In the five years since the war, 1946–1950, new generating capacity totalling 17,353,917 kw has been and will be installed by the electric utilities. Money expended and to be expended in the five years totals $9,149,985,000. On a per kilowatt basis the post-war figure of system expenditure is $528. Calculated on the basis of four post-war years, 1946–1949, a system figure of $548 per kilowatt was published in this space last year. The decline of $20 might be accounted for by the fact that the longer the period covered by the calculation the nearer the resulting figure comes to an accurate statement of cost. It is more likely, however, that the difference is caused by the continuing large addition to generating capacity and the comparatively smaller proportions of other system elements in the budget.

For 1950, the industrial states of the East North Central region again have the largest amount of utility construction. Next comes the Middle Atlantic region, displacing the Pacific states which held second place in 1948. Construction in the South Atlantic region comes third in magnitude, definitely larger than in 1949. Over half of all 1950 construction will be in the East North Central, and Middle and South Atlantic Census regions.

The estimates of expenditures and of new construction presented here and on other pages of this statistical issue are based on data compiled from ELECTRICAL WORLD's annual survey of the electricity supply industry. Replies received represent 90% of the industry in terms of generating capacity and 85% in terms of customers.

Annual Capital Expenditures for New Construction
Electric Light and Power Industry
(In Thousands of Dollars)

Year	Fuel	Hydro	Transmission	Distribution	General Plant	Total
1934	10,258	5,704	36,141	82,260	13,292	147,654
1935	16,172	6,337	42,732	110,487	17,127	192,855
1936	36,820	9,030	55,305	184,725	24,000	289,710
1937	113,060	10,540	100,400	223,620	38,600	455,480
1938	133,000	17,600	59,100	238,200	34,000	482,000
1939	101,500	17,900	61,375	226,375	22,850	430,000
1940	200,430	9,270	84,780	266,580	35,520	596,580
1941	219,741	27,186	101,085	272,449	32,687	654,148
1942†	191,671	22,847	85,633	144,180	11,644	455,975
1943	137,059	35,505	42,923	84,683	6,066	306,286
1944	96,126	19,888	61,196	151,969	11,105	340,284
1945	106,166	12,713	68,935	204,492	16,623	408,929
1946	190,955	18,974	106,550	360,980	40,710	718,169
1947	440,547	40,901	195,074	624,038	71,585	1,372,145
1948	813,025	86,188	280,530	822,275	76,070	2,078,088
1949	1,078,081	150,653	288,358	916,475	84,047	2,517,614
1950‡	1,027,943	126,557	340,484	868,411	100,574	2,463,969

Source: "Electrical World" surveys, REA and federal projects not included.
† Expenditure study not made by "Electrical World" in 1942. Figures are those reported by Federal Power Commission for privately owned utilities only.
‡ Prospective.

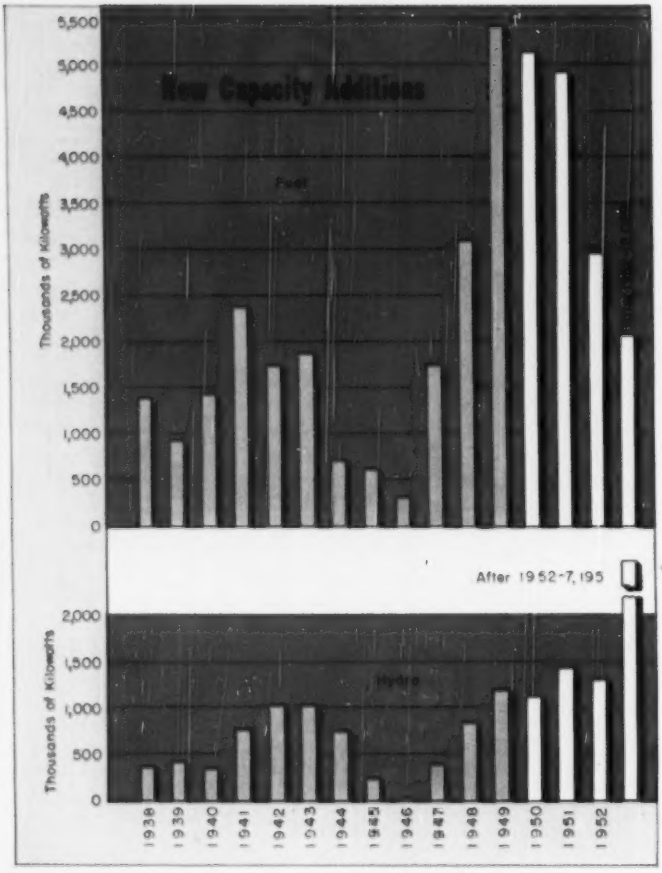
Construction Expenditures*
As Reported to Electrical World
(Thousands of Dollars)

Region	Fuel	Hydro	Transmission	Distribution	General Plant	Total
ESTIMATED—1949						
United States	1,078,081	150,653	288,358	916,475	84,047	2,517,614
New England	59,924	11,674	7,303	42,522	3,380	124,803
Middle Atlantic	150,426	3,372	27,829	147,108	10,885	339,620
East North Central	273,366	224	69,670	181,554	20,732	545,546
West North Central	185,920	8,849	29,153	76,048	12,136	312,106
South Atlantic	139,150	4,189	37,980	146,875	13,025	341,219
East South Central	34,679	1,213	13,090	46,416	3,521	98,919
West South Central	111,135	2,669	39,536	91,146	9,973	254,459
Mountain	40,820	29,689	15,400	36,122	4,340	126,371
Pacific	82,661	88,774	48,397	148,684	6,055	374,571
PROSPECTIVE—1950						
United States	1,027,943	126,557	340,484	868,411	100,574	2,463,969
New England	41,663	7,881	12,909	45,969	4,760	113,182
Middle Atlantic	175,085	3,581	36,337	148,664	13,404	377,071
East North Central	235,677	737	70,394	172,373	25,886	505,067
West North Central	165,458	6,709	32,909	77,082	16,072	298,230
South Atlantic	147,454	2,804	62,703	133,345	14,370	360,676
East South Central	39,312	1,043	15,276	41,121	3,090	99,842
West South Central	104,820	26,396	43,922	87,183	8,638	270,959
Mountain	41,547	3,684	11,464	29,586	4,179	90,460
Pacific	76,927	73,722	54,570	133,088	10,175	348,482

* Covers Power Companies, State Authorities and Municipal Systems. Does not include REA and Federal Projects.

New Capacity
6,641,543 Kw in 1949

Additions Are Continuing



MOST ADDITIONS to generating capacity in the foreseeable future will be in fuel power. The 1952 election will probably fix the proportions of fuel and hydro thereafter

New Capacity Added Each Year

Year	Megawatts		
	Fuel	Hydro	Total
1937	873	245	1,119
1938	1,350	346	1,696
1939	915	370	1,285
1940	1,361	332	1,693
1941	2,292	786	3,078
1942	1,756	1,027	2,783
1943	1,835	1,089	2,924
1944	778	768	1,546
1945	622	2.6	887
1946	355	6	361
1947	1,784	393	2,177
1948	3,132	880	4,012
1949	5,441	1,201	6,642
1950*	5,141	1,118	6,259
1951*	4,939	1,457	6,396
1952*	2,985	1,306	4,291
After 1952*	2,089	7,195	9,284

Source: "Electrical World" Surveys. *Prospective for 1949 and later.

FOR this year and next year, the power companies are planning to keep up their pace of installation of new capacity. In the year later, 1951, the power companies will slacken off a bit, but in federal projects the addition of capacity will be accelerated. The result is that for the next three years the installation of generating capacity will remain at a level of above 6 million kw annually. That is, if present plans are carried out. Time will determine the "if."

Before considering the figures of new capacity here presented, one thing should be made clear. These data were collected by ELECTRICAL WORLD from power companies, municipal systems, and federal agencies, and were supplemented by information from other available sources. The editors offer these data as the most comprehensive they are able to compile, but not as complete data or entirely free from error.

The new capacity stated here for 1949 must not be compared with the increase in capacity, 1948-1949, stated elsewhere in this issue, for two reasons. The 1949 capacity elsewhere stated is of November 1, 1949, and does not include generation facilities installed in November and December. Also the figures here presented are of *new* capacity. They are not net increase of capacity which is added capacity minus retirements.

Summary of Capacity Additions

Kilowatts

	1949	1950	1951	1952	After 1952
STEAM					
Power Companies	4,788,450	4,804,015	4,474,765	2,313,000	1,454,500
Municipal and other Government Plants	600,700	293,500	448,150	657,500	635,000
Totals, Steam	5,389,150	5,097,515	4,922,915	2,970,500	2,089,500
HYDRO					
Power Companies	439,079	360,567	136,000	265,000	143,000
Municipal and other Government Plants	761,850	757,920	1,321,100	1,040,600	7,051,760
Totals, Hydro	1,200,929	1,118,487	1,457,100	1,305,600	7,194,760
INTERNAL COMBUSTION					
Power Companies	38,147	37,850	13,000	14,500	.....
Municipal and other Government Plants	13,317	5,465	3,000	.....	.....
Totals, Internal Combustion	51,464	43,315	16,000	14,500	.....
TOTALS, ALL POWER					
Power Companies	5,265,676	5,202,432	4,623,765	2,592,500	1,597,500
Municipal and other Government Plants	1,375,867	1,056,885	1,772,250	1,698,100	7,686,760
Grand Totals	6,641,543	6,259,317	6,396,015	4,290,600	9,284,260

New Generating Capacity

STEAM

Reporting Systems	Added in 1949	1950	1951	1952	After 1952
Power Companies					
Appalachian Elec Power	125,000	.....	.....	125,000	.....
Arizona Edison	6,000	.....	.....	.....	.....
Arizona Power	4,000	.....	.....	.....	.....
Arkansas-Missouri Power	.....	33,000	.....	.....	.....
Black Hills Pwr & Lgt	10,000	.....	.....	.....	10,000
Boston Edison	81,250	.....	.....	.....	81,250
California Elec Power	.....	.....	.....	.....	60,000
Carolina Power & Light	44,000	44,000	66,000	66,000	.....
Central Arizona Lgt & Pwr	12,500	60,000	.....	.....	.....
Central Hudson Gas & Elec	.....	.....	.....	60,000	.....
Central Ill Elec & Gas	20,000	.....	.....	30,000	.....
Central Illinois Light	35,000	.....	.....	60,000	.....
Central Illinois Pub Ser	50,000	60,000	.....	60,000	.....
Central Louisiana Elec	10,000	.....	.....	.....	15,000
Central Ohio Lgt & Pwr	.....	.....	12,000	.....	.....
Central Power & Light	50,000	.....	30,000	.....	30,000
Cincinnati Gas & Electric	80,000	.....	100,000	.....	.....
Citizens Utilities	.....	.....	.....	.....	10,000
Cleveland Elec Illum	150,000	60,000	60,000	.....	.....
Columbus & Southern Ohio Electric	70,000	40,000	60,000	.....	.....
Commonwealth Edison & Subsidiaries	130,000	257,000	150,000	110,000	.....
Community Public Service	11,500	.....	.....	.....	.....
Connecticut Lgt & Pwr	.....	60,000	60,000	.....	.....
Consolidated Edison of N. Y.	160,000	60,000	120,000	120,000	.....
Consolidated Gas Electric Light & Power of Baltimore	.....	66,000	75,000	.....	.....
Consumers Power	120,000	120,000	.....	85,000	.....
Dallas Power & Light	60,000	25,000	60,000	.....	60,000
Dayton Power & Light	60,000	60,000	60,000	.....	.....
Delaware Power & Light	.....	.....	120,000	.....	60,000
Detroit Edison	100,000	100,000	200,000	.....	.....
Duke Power	70,000	160,000	90,000	90,000	.....
Duquesne Light	65,000	65,000	.....	160,000	.....
Eastern Shore Public Service of Maryland	15,000	.....	30,000	.....	.....
Eastern Shore Public Service of Virginia	.....	.....	.....	.....	15,000
El Paso Electric	20,000	.....	30,000	.....	.....
Empire District Electric	.....	30,000	.....	.....	.....
Florida Power	10,000	.....	40,000	15,000	40,000
Florida Power & Light	40,000	16,000	30,000	.....	.....
Georgia Power & Light	6,000	.....	.....	.....	.....
Gulf States Utilities	40,000	120,000	60,000	.....	60,000
Hartford Electric Light	.....	45,000	.....	.....	.....
Houston Lighting & Power	132,000	108,000	75,000	.....	.....
Illinois Power	94,000	127,000	.....	.....	.....
Indiana-Michigan Electric	125,000	.....	125,000	.....	.....
Indianapolis Power & Light	40,000	40,000	.....	40,000	.....
Interstate Power & Subsidiaries	11,300	11,500	11,500	25,000	.....
Iowa Elec Light & Power	.....	25,000	.....	.....	.....
Iowa-Illinois Gas & Elec	45,300	.....	.....	.....	.....
Iowa Power & Light	7,800	40,000	.....	.....	.....
Iowa Public Service	25,000	.....	24,000	7,500	10,000
Iowa Southern Utilities	15,600	.....	24,000	7,500	10,000
Jersey Central Pwr & Lgt	33,500	.....	.....	50,000	.....
Kansas City Power & Light	9,000	12,500	132,000	.....	.....
Kansas Gas & Electric	30,000	.....	.....	40,000	.....
Kansas Power & Light Co	30,000	40,000	.....	.....	30,000
Kentucky Utilities	33,000	33,000	33,000	.....	33,000
Lake Superior District Pwr	20,000	.....	.....	.....	.....
Long Island Lighting Sys	.....	44,000	.....	.....	.....
Louisville Gas & Electric	60,000	60,000	.....	.....	.....
Luzerne County Gas & Electric	.....	.....	.....	.....	25,000
Metropolitan Edison	.....	150,000	.....	.....	.....
Middle South Utilities	110,000	264,000	198,000	.....	.....
Minnesota Power & Light	33,000	.....	33,000	.....	.....
Mississippi Valley Pub Ser	.....	.....	15,000	.....	.....
Missouri Power & Light	7,500	11,500	.....	.....	.....
Missouri Public Service	7,500	.....	.....	.....	.....
Missouri Utilities	8,000	.....	.....	.....	.....
Monongahela Power	60,000	.....	80,000	.....	60,000
Montana-Dakota Utilities	7,500	.....	.....	.....	.....
Montana Power	.....	.....	66,000	.....	.....
Montaup Electric	.....	.....	66,000	.....	.....
New England Electric Sys	40,000	30,000	75,000	75,000	.....
New England Gas & Elec	15,000	45,000	.....	.....	.....
New Jersey Power & Light	66,000	.....	.....	.....	.....
New York State Elec & Gas	.....	70,000	75,000	40,000	.....
Niagara-Mohawk Power	.....	180,000	90,000	180,000	.....
Northern Indiana Pub Ser	.....	70,015	70,015	.....	.....
Northern States Power (Minn)	104,500	65,000	12,500	60,000	.....
Northern States Pwr (Wis)	23,000	.....	.....	.....	.....
Northwestern Public Ser	.....	.....	.....	11,500	.....
Ohio Edison	112,000	60,000	.....	.....	.....
Ohio Power	.....	125,000	.....	125,000	.....
Ohio Public Service	60,000	90,000	.....	.....	.....
Oklahoma Gas & Electric	7,000	50,000	50,000	.....	33,000
Otter Tail Power	12,500	15,000	15,000	.....	.....
Pacific Gas & Electric	100,000	180,000	500,000	.....	.....
Pennsylvania Electric	34,500	46,000	63,250	60,000	.....
Pennsylvania Power	.....	.....	85,000	.....	.....
Pennsylvania Pwr & Lgt	150,000	.....	100,000	.....	.....
Peoples Gas & Electric	7,500	.....	.....	.....	.....
Philadelphia Electric	120,000	165,000	.....	.....	250,000
Potomac Edison	34,500	.....	.....	.....	50,000
Potomac Electric Power	80,000	80,000	.....	25,000	.....
Public Electric Power	.....	.....	3,500	.....	.....
Public Service of Colo	40,000	40,000	.....	.....	.....
Public Service of Ind	35,000	40,000	100,000	.....	.....
Public Service of N. H	40,000	.....	.....	40,000	.....
Public Service of Okla	10,000	30,000	.....	5,000	.....
Public Service Elec & Gas	110,000	.....	125,000	.....	.....
Rochester Gas & Electric	40,000	.....	50,000	.....	100,000
Rockland Light & Power	22,000	.....	22,000	.....	.....
San Diego Gas & Electric	.....	50,000	.....	50,000	.....
Savannah Electric & Power	20,000	.....	.....	.....	.....

Reporting Systems	Added in 1949	1950	1951	1952	After 1952
Power Companies					
Scranton Electric					35,000
Southern Carolina Elec & Gas-Southern Carolina Power		22,500	40,000		
Southern Company	187,500	200,000	180,000	100,000	
Southern California Edison	132,000				
Southern Colorado Power	15,000		7,500		
So. Indiana Gas & Electric	20,000		20,000		
Southwestern Gas & Elec.	25,000	30,000	30,000		
Southwestern Public Ser.	40,000	37,500	37,500	50,000	
Staten Island Edison				30,000	
St. Joseph Light & Power		12,500	20,000		
Tampa Electric		60,000			
Texas Electric Service	50,000	115,000		75,000	
Texas Power & Light		70,000			66,000
Toledo Edison			75,000		
Tucson Gas Elec Lgt & Pwr	24,000				
Union Electric of Missouri & Subsidiaries		160,000		110,000	110,000
United Illuminating		30,000			
Utah Power & Light		43,000	63,000	63,000	
Virginia Electric & Power	60,000	100,000	60,000		
Western Lgt & Telephone	6,000	5,000			
Western Mass Electric	45,000				45,000
West Penn Power	110,000	40,000			95,000
West Texas Utilities	15,000		30,000		30,000
Wisconsin Electric Power	80,000		80,000		
Wisconsin Power & Light	25,000		60,000		
Wisconsin Public Service	50,000			62,500	31,250
Totals	4,788,450	4,804,015	4,474,765	2,313,000	1,454,500
Municipal and Other Public Plants					
Ames, Iowa		7,500			
Atlantic, Iowa	3,500				
Austin, Texas		20,000	20,000		
Burbank, Calif	20,000		20,000		
Chambersburg, Pa		5,000			5,000
Chanute, Kan	4,000				6,000
Cheyenne Lgt, Fuel & Pwr					10,000
Chicago, Ill			10,000		
Cleveland, Ohio			50,000		
Coffeyville, Kan	10,000				
Colorado Springs, Colo	10,000			15,000	
Columbus, Ohio	12,500				
Crawfordsville, Ind	7,500				
Danville, Va	6,000				
Decatur, Ind	10,000				
Detroit, Mich		40,000			
Eugene, Ore	20,000				
Fairmont, Minn	3,200				
Ft. Collins, Colo		10,000			15,000
Fort Wayne, Ind	10,000	10,000			
Frankfort, Ind	10,000				
Fremont, Neb		10,000			
Glendale, Cal				20,000	
Grand Island, Neb					7,500
Grand River Dam Authority	10,000	15,000			
Hannibal, Mo		10,000			
Hastings, Neb		6,000			
Hibbing, Minn					7,500
Holland, Mich					11,500
Holyoke, Mass		7,500			
Imperial Irrigation Dist, Calif	20,000			30,000	
Jacksonville, Fla			60,000		
Jamestown, N. Y		20,000			
Jonesboro, Ark	7,500				
Kansas City, Kan			30,000		
Key West, Fla			3,000		
Lakeland, Fla		20,000			
Lansing, Mich	25,000	25,000			
Los Angeles, Calif	150,000				
Lubbock, Tex	7,500	7,500			
McPherson, Kan	7,500				12,500
Menasha, Wis	8,000				
Moorhead, Minn			60,150		
Muscatine, Iowa	12,500				
Nebraska Public Power	30,000	45,000		30,000	
Norwich, Conn					7,500
Omaha Public Power Dist	30,000		40,000		
Orlando, Fla	25,000				
Orrville, Ohio	5,000				10,000
Owatonna, Minn	4,000				
Owensboro, Ky		7,500			
Pasadena, Cal	35,000				40,000
Piqua, Ohio					15,000
Popular Bluff, Mo	3,000				
Provo, Utah	7,500				10,000
Rochester, Minn	7,500				
Rocky Mount, N. C	15,000				
Salt River Project, Ariz	7,500				
San Antonio, Tex	30,000		30,000		30,000
Taunton, Mass		10,000			15,000
Tennessee Valley Auth			112,500	562,500	425,000
Traverse City, Mich	5,000	7,500	7,500		
Troy, Ohio		10,000			
Vineland, N. J	5,000				7,500
Virginia, Minn	5,000				
Watertown, S. D			5,000		
Wyandotte, Mich	11,500				
Totals	600,700	293,500	448,150	657,500	635,000

HYDRO

Reporting Systems	Added in 1949	1950	1951	1952	After 1952
Power Companies					
Bangor Hydro-Electric	1,880				
California Oregon Power	28,314	32,167	11,000	6,000	68,000
California-Pacific Util	225				
Central Hudson Gas & Elec				25,000	
Central Maine Power	8,400	6,000			
Central Vermont Pub Ser		2,500			
Holyoke Water Power			15,000		
Idaho Power	115,000	25,000		50,000	30,000
Indiana & Michigan Elec	1,500				
Minnesota Power & Light	19,000				
Montana Power	56,000				
Nantahala Power & Light	1,440	3,000			
New England Electric Sys		33,000			
Niagara-Mohawk Power	40,000				30,000
Northern States Pwr (Minn)		34,000		8,000	
Northern States Pwr (Wis)		37,500			
Pacific Gas & Electric	91,500	113,400			
Pacific Power & Light	45,000				
Public Service of N. H			6,000		
Southern Company	20,000	74,000	20,000	85,000	
Southern California Edison			84,000		
Virginia Electric & Power				91,000	
Wisconsin Michigan Pwr	17,800				
Wisconsin Public Service					15,000
Totals	439,079	360,567	136,000	265,000	143,000
Municipal and Other Public Plants					
Carthage, Mo	3,750				
Chicago, Ill		4,000			
Consumers Pub Pwr Dist	500				
Corps of Engineers, U.S.A.	88,000	136,500	164,800	146,000	6,173,000
Imperial Irrigation Dist, Calif		10,000			10,000
Los Angeles, Calif			112,000		
Lower Colorado River Authority		14,000	30,000	45,000	
Seattle, Wash			60,000	90,000	180,000
South Carolina Public Service Authority		1,920			
Tennessee Valley Auth	165,600	147,400	96,800	213,100	80,000
Bureau of Reclamation	504,000	444,100	857,500	346,500	608,760
Totals	761,850	757,920	1,321,100	1,040,600	7,051,760

INTERNAL COMBUSTION

Reporting Systems	Added in 1949	1950	1951	1952	After 1952
Power Companies					
Bangor Hydro-Electric	2,000	8,000		6,000	
California-Pacific Util	350				
Central Electric & Gas	1,450	1,000			
Central Maine Power		3,500			
Central States Electric	5,750	1,150			
Central Vermont Pub Ser			6,000	6,000	
Citizens Utilities	3,680		2,000	2,500	
Duke Power	500				
Eastern Shore Public Service of Virginia	500				
Iowa Electric Lgt & Pwr	5,000				
Iowa Public Service	1,136				
Iowa Southern Utilities	5,000		5,000		
Maine Public Service		7,500			
Michigan Public Service	330				
Middle South Utilities		100			
Mountain States Power	1,000				
Northwestern Public Ser		4,500			
Otter Tail Power	2,600				
Public Electric Light		2,000			
Public Service of Okla		6,000			
Utah Power & Light	136	1,000			
Virginia Electric & Power	1,000	600			
Western Light & Telephone	7,715	9,500			
Totals	38,147	37,850	13,000	14,500	
Municipal and Other Public Plants					
Freeport, N. Y	2,715	2,715			
Gainesville, Fla	1,162				
Harrisonburg, Va	1,690				
Hudson, Mass			3,000		
McPherson, Kan	1,000				
Peabody, Mass	6,750				
Rockville Centre, N. Y		2,750			
Totals	13,317	5,465	3,000		

Number and Generating Capacity of Electric Utility Generating Plants by Division and Type of Prime Mover

December 31, 1949

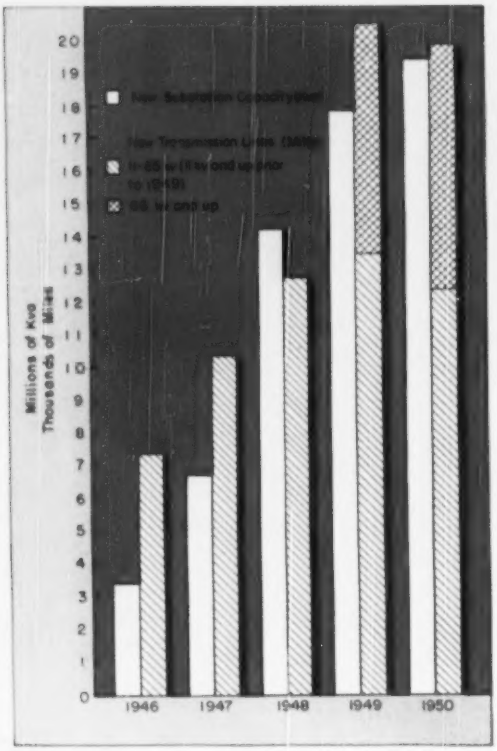
Division and State	Number of Utilities	Number of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plants Operated by*					
				Water Power		Steam Power		Internal Combustion Engines	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	[b]1,607	[a]3,910	61,166,285	1,471	16,391,638	1,050	43,043,394	1,389	1,731,253
New England	102	318	3,732,153	215	930,641	66	2,744,815	37	56,697
Maine	19	87	384,171	62	262,607	6	100,000	19	21,564
New Hampshire	12	51	349,785	43	247,805	5	97,750	3	4,230
Vermont	19	73	190,599	59	166,012	7	14,750	7	9,837
Massachusetts	36	70	1,541,367	32	164,247	32	1,361,375	6	15,745
Rhode Island	6	10	362,421	4	3,250	5	358,950	1	221
Connecticut	10	27	903,810	15	86,720	11	811,990	1	5,100
Middle Atlantic	111	362	12,459,087	192	1,592,466	137	10,815,592	33	51,029
New York	58	226	5,995,173	160	1,163,695	46	4,795,175	20	36,303
New Jersey	11	24	1,971,207	3	7,270	17	1,960,635	4	3,302
Pennsylvania	42	112	4,492,707	29	421,501	74	4,059,782	9	11,424
East North Central	305	684	13,960,869	295	743,968	237	12,962,056	152	254,845
Ohio	63	101	3,917,065	6	11,525	75	3,879,617	20	25,923
Indiana	47	80	1,909,099	22	36,944	41	1,841,380	17	30,775
Illinois	63	97	3,770,259	12	48,629	59	3,681,634	26	39,996
Michigan	66	212	2,776,597	131	367,291	32	2,303,275	49	106,031
Wisconsin	66	194	1,587,849	124	279,579	30	1,256,150	40	52,120
West North Central	478	908	4,383,152	125	575,373	210	3,118,985	573	688,794
Minnesota	80	172	1,017,294	42	137,957	49	754,304	81	125,033
Iowa	98	203	995,771	31	135,316	48	670,879	124	189,576
Missouri	74	114	874,255	6	150,525	26	627,165	82	96,565
North Dakota	16	49	152,802	.....	.....	16	116,815	33	35,987
South Dakota	41	77	140,404	5	3,425	12	80,112	60	56,867
Nebraska	84	158	498,653	35	141,533	26	279,660	97	77,460
Kansas	85	135	703,973	6	6,617	33	590,050	96	107,306
South Atlantic	140	395	7,668,909	160	2,222,777	125	5,313,595	110	132,537
Delaware	6	7	28,108	.....	.....	4	23,150	3	4,958
Maryland	13	28	1,024,789	3	271,325	14	741,525	11	11,939
District of Columbia	2	3	508,000	1	3,000	2	505,000	.....	.....
Virginia	22	74	1,042,678	38	182,246	19	836,755	17	23,677
West Virginia	11	36	1,005,905	11	100,940	15	900,010	10	4,955
North Carolina	29	81	1,546,848	49	659,035	19	869,721	13	18,092
South Carolina	14	41	823,203	27	650,676	9	167,430	5	5,097
Georgia	12	45	867,616	27	342,892	13	520,950	5	3,774
Florida	31	80	821,762	4	12,663	30	749,054	46	60,045
East South Central	59	131	4,021,479	39	2,483,098	57	1,513,559	35	24,822
Kentucky	15	31	719,157	4	270,860	23	443,001	4	5,296
Tennessee	15	37	1,610,538	23	1,187,875	10	419,450	4	3,213
Alabama	4	27	1,528,013	12	1,024,363	10	500,340	5	3,310
Mississippi	25	36	163,771	.....	.....	14	150,768	22	13,003
West South Central	175	407	3,873,119	36	385,247	103	3,179,775	268	308,097
Arkansas	23	43	329,384	6	102,008	14	201,445	23	25,931
Louisiana	32	64	715,770	.....	.....	12	657,700	52	58,070
Oklahoma	50	99	616,243	4	73,624	24	476,570	71	66,049
Texas	70	201	2,211,722	26	209,615	53	1,844,060	122	158,047
Mountain	177	418	3,047,586	197	2,171,388	66	717,718	155	158,480
Montana	14	33	448,771	20	432,638	4	11,968	9	4,165
Idaho	14	49	356,630	41	351,646	1	400	7	4,584
Wyoming	29	56	104,407	16	54,750	12	40,560	28	9,097
Colorado	45	88	388,485	30	86,985	23	276,048	35	25,452
New Mexico	22	46	250,832	6	25,090	13	193,142	27	32,600
Arizona	18	52	725,185	15	540,759	9	126,850	28	57,576
Utah	27	78	179,604	59	93,245	4	68,750	15	17,609
Nevada	8	16	593,672	10	586,275	.....	.....	6	7,397
Pacific	60	287	8,019,931	212	5,286,680	49	2,677,299	26	55,952
Washington	20	55	2,400,944	40	2,196,736	9	200,820	6	3,388
Oregon	19	71	907,823	50	709,899	13	190,310	8	7,614
California	21	161	4,711,164	122	2,380,045	27	2,286,169	12	44,950

Source: Federal Power Commission.

Notes: * For the approximately 175 combination plants each type of prime mover is counted as a separate plant.
[b] Total includes 84 duplications because of utilities having generating plants in more than one state.

Large Building Program

Construction of lines and subs continues at 1949 rate



TRANSMISSION LINE and substation construction is planned for 1950 in about the same amount as was completed in 1949

CONSTRUCTION of transmission lines in 1949 was nearly 50% greater than had been predicted at the beginning of the year. In 1950 it will go on at about the same rate. This is a direct result of continuing additions to generating capacity. In both capacity and expenditure, substation construction in 1950 will be practically equal to that in 1949.

These construction data are for power companies and for municipal and other local government systems. They do not include construction on federal projects and by REA cooperatives.

Construction of Substation
(In Thousands of Kva)

Region	1946	1947	1948	1949	1950*
New England	155	421	497	546	985
Middle Atlantic	370	1,259	2,193	1,950	2,135
E. N. Central	800	1,235	3,399	3,887	4,662
W. N. Central	160	491	1,414	1,936	2,368
South Atlantic	330	764	1,935	2,545	2,636
E. S. Central	260	349	683	943	887
W. S. Central	262	754	996	2,284	2,726
Mountain	32	266	601	912	813
Pacific	1,000	1,228	2,441	2,775	2,228
United States	3,319	6,767	14,158	17,779	19,441

Source: "Electrical World" Surveys. *Estimated.

Substation Construction Expenditures
(In Thousands of Dollars)

Region	1946	1947	1948	1949	1950*
New England	6,259	13,495	12,170	14,337	13,007
Mid. Atlantic	7,960	25,902	31,160	37,793	49,878
E. N. Central	14,520	32,915	49,095	54,015	72,711
W. N. Central	3,330	13,059	15,755	47,766	46,255
So. Atlantic	9,740	19,621	31,170	43,608	39,675
E. S. Central	3,250	6,379	11,050	14,859	14,394
W. S. Central	4,610	13,083	17,275	32,446	31,043
Mountain	1,785	4,870	11,245	15,048	10,987
Pacific	11,300	27,790	52,690	57,667	50,543
United States	62,754	157,114	231,610	317,541	328,494

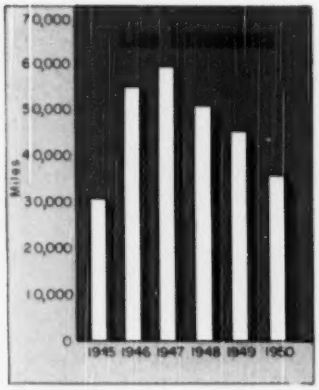
Source: "Electrical World" Surveys. *Estimated.

Construction of Transmission
(In Miles)

Region	1947	1948	1949		1950*	
	(11 kv and up)		(11–65 kv)	(66 kv and up)	(11–65 kv)	(66 kv and up)
New England	210	307	167	91	279	70
Mid. Atlantic	992	882	790	488	934	522
E. N. Central	1,060	2,680	1,834	1,359	1,904	1,059
W. N. Central	1,560	3,041	1,292	905	1,462	571
So. Atlantic	1,902	1,199	2,467	982	2,515	1,588
E. S. Central	337	430	375	439	229	396
W. S. Central	1,733	1,564	3,823	1,166	3,049	1,361
Mountain	533	983	1,933	730	1,326	1,070
Pacific	1,913	1,767	755	968	676	871
United States	10,240	12,853	13,436	7,128	12,374	7,508

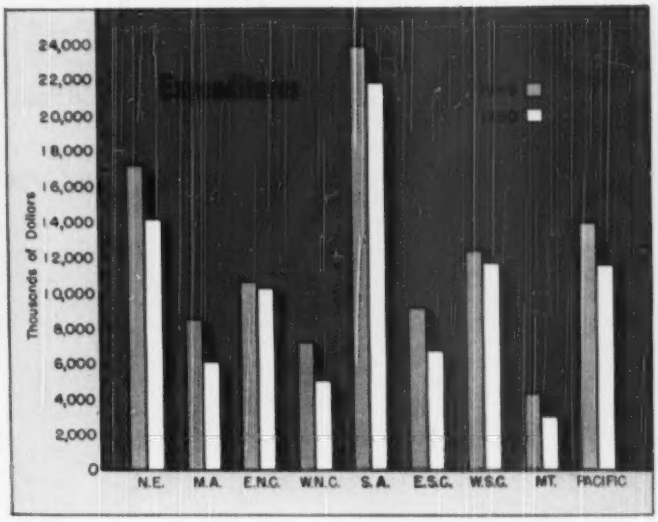
Source: "Electrical World" Surveys. *Estimated.

Rural Lines
$78,009,600



DECREASE in rural extensions does not apply to REA co-ops. Their expenditures for rural lines are still on the increase

EXPENDITURES per mile of line in 1950 have risen to $2,175, compared to the $2,000 per mile which was spent last year



Line Building Tapers Off

Improvement of systems gets growing share of expenditures

DECLINE in expenditures by electric utilities for rural lines continues through 1950. The much larger proportionate decrease in miles of line—45,462 in 1949 and 36,214 in 1950—than in money—$91,665,700 and $78,009,600—suggests that improvement of systems is receiving a growing share of rural line expenditures. This conclusion is supported by the difference between the two years in money expended per mile of line. In 1949 the amount per mile was about $2,000. For 1950 the projected amount is a little under $2,200, an increase of 7% over 1949.

Miles of Rural Line Extensions*

Region	1946	1947	1948	1949	1950†
New England	2,242	1,873	2,138	808	593
Middle Atlantic	6,220	6,138	3,515	2,995	2,455
E. N. Central	9,290	7,038	7,362	4,103	3,086
W. N. Central	3,860	5,653	6,576	4,776	3,996
South Atlantic	12,200	14,143	12,810	12,538	10,026
E. S. Central	5,720	6,377	4,506	4,947	3,486
W. S. Central	8,335	9,004	7,815	7,030	6,275
Mountain	3,550	2,254	3,357	3,012	2,052
Pacific	3,970	6,647	4,298	5,253	4,245
United States	55,387	59,127	52,377	45,462	36,214

Source: "Electrical World" Surveys.
* REA not included. † Estimated.

Rural Line Construction Expenditures*
(In Thousands of Dollars)

Region	1948	1949	1950†
New England	6,315	1,723	1,411
Middle Atlantic	10,600	8,555	6,129
E. N. Central	14,985	10,655	10,387
W. N. Central	13,085	7,169	5,132
South Atlantic	24,680	23,971	21,898
E. S. Central	12,280	9,103	6,795
W. S. Central	12,755	12,301	11,698
Mountain	3,960	4,290	3,046
Pacific	14,950	13,897	11,514
United States	113,610	91,666	78,010

Source: "Electrical World" Surveys.
* REA not included. † Estimated.

Maintenance
$358,539,500

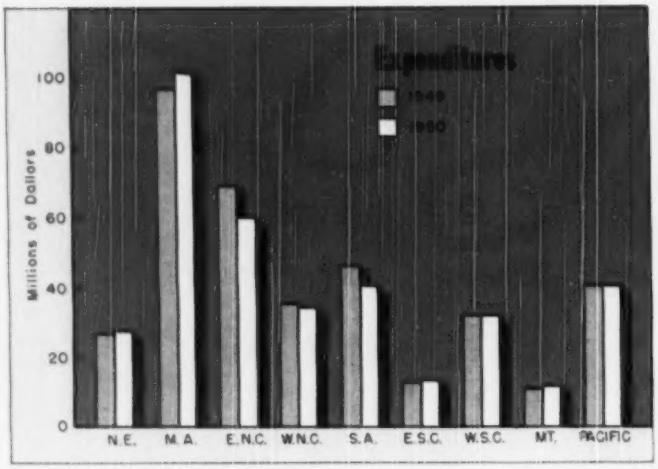
Still At High Level

War-year deferments are evidently not yet entirely caught up

Maintenance Expenditures
(Thousands of Dollars)

Region	1949	1950*
New England	26,177.4	27,279.5
Mid. Atlantic	96,178.1	101,083.8
E.N. Central	68,239.6	60,046.6
W. N. Central	35,061.4	34,253.4
South Atlantic	45,947.7	40,282.0
E. S. Central	12,703.2	13,021.1
W. S. Central	31,689.0	31,714.8
Mountain	10,088.2	10,628.3
Pacific	40,240.2	40,230.0
United States	366,324.8	358,539.5

Source: "Electrical World" Surveys.
*Estimated.



MAINTENANCE EXPENDITURES are highest in Middle Atlantic states, although the East North Central region leads in energy output and sales

EXPENDITURES for maintenance projected for 1950 are a little less than for 1949, but the difference is small.

Although the figures in the two tables on this page are from different sources—The Federal Power Commission and ELECTRICAL WORLD's annual survey—and thus are not directly comparable, there appears to be sufficient agreement between them to allow certain comment. This is that maintenance deferred during the war years is probably not yet entirely done.

The totals show a continuous rise from the war years to a high in 1949 of over $366 million; double the expenditure in 1944. The $359 million projected for 1950 indicates the probability that the more important deferred items have been taken care of, but much work still remains.

Maintenance Expenditures
Privately Owned Class A and B Electric Utilities
(Thousands of Dollars)

	1944	1945	1946	1947	1948
Steam	72,825—39.8%	79,751—40.8%	77,327—37.3%	96,683—37.8%	109,489—37.4%
Hydro	10,583— 5.8	12,033— 6.2	11,287— 5.4	12,056— 4.7	12,798— 4.3
Int. Comb	1,020— 0.6	1,116— 0.6	1,365— 0.7	1,784— 0.7	2,322— 0.8
Transmission	16,151— 8.9	16,753— 8.6	18,846— 9.2	22,414— 8.8	24,335— 8.3
Distribution	76,700—42.0	79,416—40.5	91,484—44.1	114,160—44.5	134,939—45.9
General	5,243— 2.9	6,445— 3.3	6,926— 3.3	8,892— 3.5	9,771— 3.3
Totals	182,522—100	195,514—100	207,235—100	255,989—100	293,654—100

Source: Federal Power Commission.

Customers
42,836,000

Central Station Customers at End of Year*
(All Agencies, Public and Private)

	United States	New England	Middle Atlantic	East No. Central	West No. Central	South Atlantic	East So. Central	West So. Central	Mountain	Pacific
Total										
1949	42,835,800	2,995,900	9,231,500	9,169,800	4,096,800	5,092,600	2,528,100	3,632,600	1,409,100	4,679,400
1948	40,721,988	2,923,512	8,985,625	8,881,978	3,865,399	4,687,598	2,261,229	3,338,098	1,312,894	4,465,655
Change	2,113,812	72,388	245,875	287,822	231,401	405,002	266,871	294,502	96,206	213,745
Rural †										
1949	1,816,400	18,300	42,600	425,600	228,100	174,500	161,400	272,400	39,600	453,900
1948	1,694,579	15,630	39,629	434,883	206,995	156,690	147,094	237,125	36,740	419,793
Change	121,821	2,670	2,971	−9,283	21,105	17,810	14,306	35,275	2,860	34,107
Residential										
1949	35,354,500	2,586,900	7,841,300	7,621,000	3,312,100	4,290,100	2,099,100	2,894,400	1,175,000	3,534,600
1948	33,549,396	2,523,834	7,650,061	7,349,083	3,109,986	3,935,909	1,857,624	2,650,595	1,089,898	3,382,406
Change	1,805,104	63,066	191,239	271,917	202,114	354,191	241,476	243,805	85,102	152,194
Commercial & Industrial										
1949	5,515,900	380,600	1,322,000	1,092,000	543,400	611,000	254,300	451,100	190,500	671,000
1948	5,335,960	374,082	1,271,191	1,067,639	534,891	579,241	244,583	436,681	182,445	645,207
Change	179,940	6,518	50,809	24,361	8,509	31,759	9,717	14,419	8,055	25,793
Municipal, Rail and Miscellaneous										
1949	149,000	10,100	25,600	31,200	13,200	17,000	13,300	14,700	4,000	19,900
1948	142,053	9,966	24,744	30,373	13,527	15,758	11,928	13,697	3,811	18,249
Change	6,947	134	856	827	−327	1,242	1,372	1,003	189	1,651

Source: Edison Electric Institute. * Estimated. † Customers served on distinct rural rates; rural customers served on urban rates not included.

Rapid Increase Continues

Southeastern states lead in connection of new customers

LAST YEAR, electric utilities added 2,113,812 new customers to their lines. This was a decrease of 176,226 from the number added in 1948. It appears that the post-war increase has passed the peak and that succeeding years will see addition of customers gradually coming into parallel with population growth.

About a million new dwelling units were constructed in 1949, but the number of domestic customers (rural plus residential in the table) increased by 1,926,925. The difference between new dwellings and customer increase is largely accounted for by new farm and other rural connections. The REA data in this issue show 525,550 new customers on co-op lines. The remainder of the increase represents connections of farms and other existing dwellings to power company and municipal systems.

Increase in number of commercial and industrial customers was about the same last year as in 1948, 179,940 and 183,702. The rate of increase in 1948 was 3.6%, and in 1949, 3.4%. These rates compare with the respective increases of 9.6% and 5.9% in 1946 and 1947.

Regionally, the largest increase in customers occurred in the South Atlantic states, the number rising 8.6% from 4,687,598 to 5,092,600. The region with the largest number of customers is the Middle Atlantic. But here the increase was only 2.7% and in number considerably less than for the South Atlantic.

Energy Sales
248,750,000,000 Kwhr

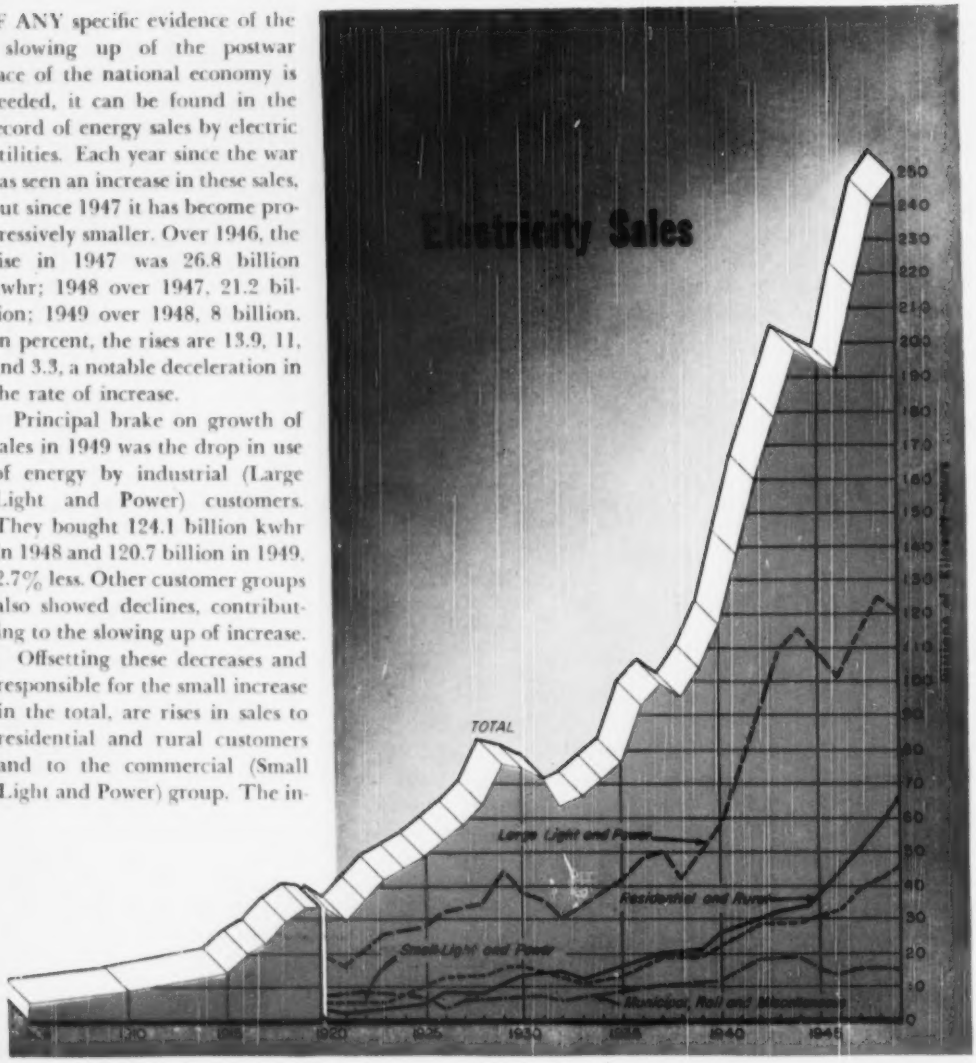
Rate of Increase Decelerates

Sales to industrials fall off and slow up the general rise

IF ANY specific evidence of the slowing up of the postwar pace of the national economy is needed, it can be found in the record of energy sales by electric utilities. Each year since the war has seen an increase in these sales, but since 1947 it has become progressively smaller. Over 1946, the rise in 1947 was 26.8 billion kwhr; 1948 over 1947, 21.2 billion; 1949 over 1948, 8 billion. In percent, the rises are 13.9, 11, and 3.3, a notable deceleration in the rate of increase.

Principal brake on growth of sales in 1949 was the drop in use of energy by industrial (Large Light and Power) customers. They bought 124.1 billion kwhr in 1948 and 120.7 billion in 1949, 2.7% less. Other customer groups also showed declines, contributing to the slowing up of increase.

Offsetting these decreases and responsible for the small increase in the total, are rises in sales to residential and rural customers and to the commercial (Small Light and Power) group. The in-



crease in residential and rural sales was 8.6 billion kwhr, more than twice the drop in the industrial classification, and the increase to commercial customers was 2.9 billion, about 75% of the industrial sales decline. These figures emphasize the stability and the potentiality of the domestic and commercial classes of business and tell in no uncertain terms in which directions utility sales efforts should be pointed.

In 1947 the increase in residential sales was 5.6 billion kwhr over 1946. The 1948 increase was 6.8 billion and for 1949 it was 7.6 billion. This acceleration of growth in volume of energy sold results from two factors. One is increase in number of customers and the other is larger use per customer. Increase in average use, shown on another page in this issue, was 7.8% in 1949. The volume increase, from 51 billion kwhr to 58.5 billion, was 14.7%. Thus it is seen that new customers contributed importantly to the increase in energy sales.

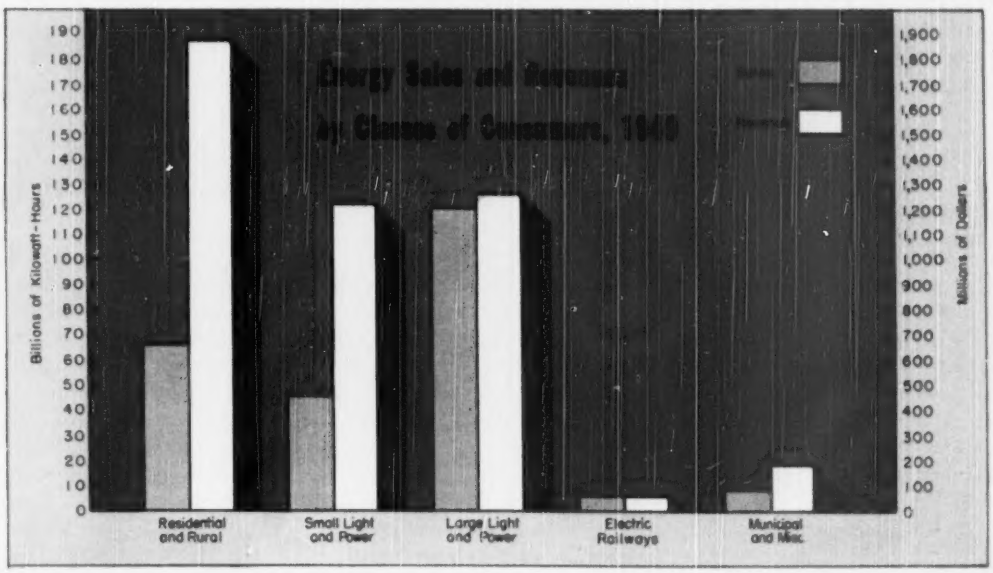
The drop in industrial sales in 1949 accentuated strongly the trend of enlarging proportion of residential in total energy sales. In 1947 the proportion was 20.3% and in 1948, 21.7%. The increase to 23.6% in 1948 gives more of a rise to the trend. This trend is important because it presages significant developments in electricity supply system design and operation.

The continuing decline in energy sold to street railways and to railroads is a tribute to the growing dominance of the internal combustion engine in the field of public transportation. And the results of promotional effort in street and highway lighting can be seen in the consistent annual increase in that category of energy sales.

Energy Sales to Ultimate Consumers
(In Millions of Kwhr)

Year	Rural*	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to Ultimate Consumers
1936..	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937†.	1,670	17,691	18,075	51,360	1,863	4,428	1,284	2,987	99,359
1938..	1,577	19,371	19,137	43,140	1,929	3,989	1,449	3,138	93,731
1939..	1,881	21,084	20,722	51,108	2,002	3,918	1,847	3,205	105,768
1940..	1,991	23,318	22,373	59,557	2,048	3,974	1,935	3,447	118,643
1941..	2,352	25,124	24,628	76,060	2,111	3,960	2,118	3,707	140,060
1942..	2,890	26,937	27,234	88,378	2,061	4,256	2,372	5,280	159,408
1943..	2,996	28,621	28,192	106,657	2,075	4,696	2,530	10,122	185,889
1944..	3,373	31,266	29,837	115,187	2,163	4,635	2,694	9,006	198,161
1945..	3,668	34,184	30,438	107,490	2,184	4,683	2,671	8,240	193,558
1946..	4,431	38,571	33,016	98,885	2,272	4,515	2,632	5,473	190,794
1947..	5,551	44,171	38,379	113,523	2,365	4,487	2,617	6,487	217,581
1948..	6,327	50,978	43,193	124,088	2,525	4,109	2,611	6,909	240,740
1949**	7,425	58,500	46,125	120,750	2,715	3,700	2,400	7,125	248,750

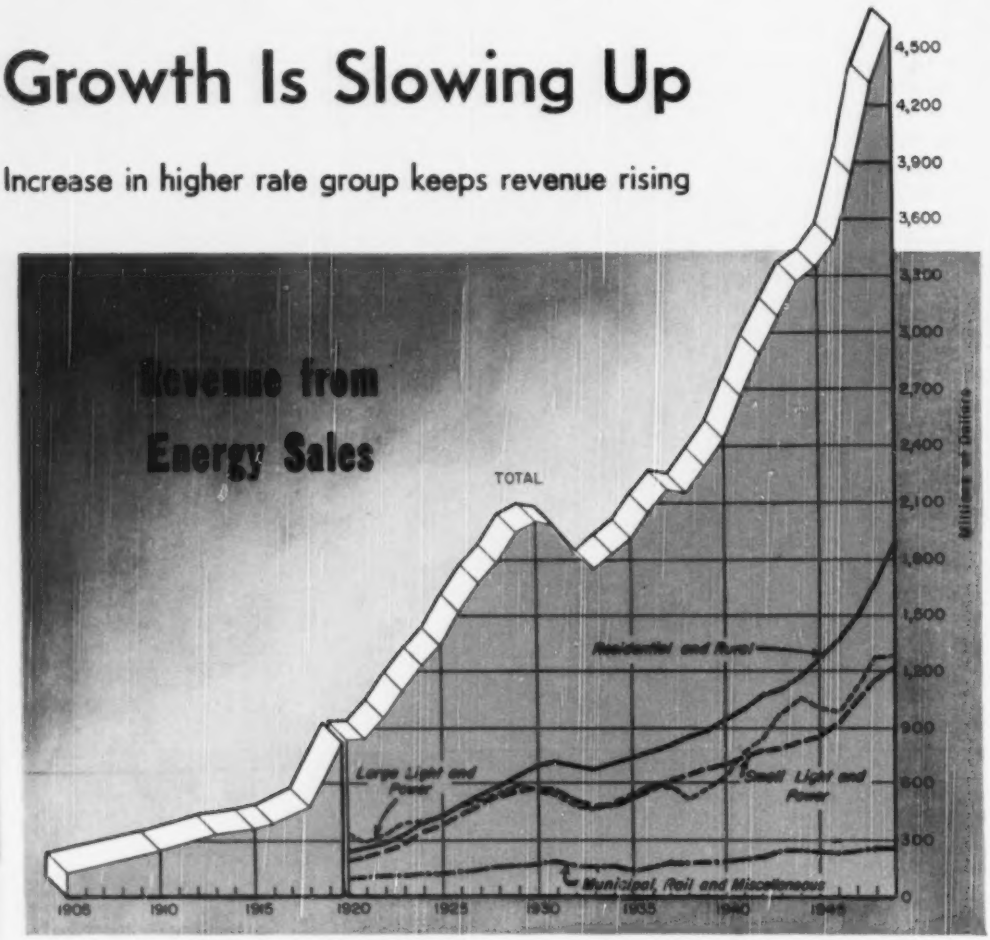
Source: Edison Electric Institute. *Sales on distinct rural rates. **Estimated. †Revised figures to conform with Uniform System of Account prescribed by Federal Power Commission from 1937.



Revenue
$4,611,000,000

Growth Is Slowing Up

Increase in higher rate group keeps revenue rising



OVER 1948, revenue of electric utilities was up 6.9% for 1949. Energy sales in 1949 were only 3.3% above 1948. Cause was an increase of sales in the higher, and a decrease in the lower, rate brackets. The disparity of increase between the two groups is striking. For the Residential, Rural, and Small Light and Power customer classes, the 1949 revenue increase over 1948 was 9.7%. For all other customer classes the increase was only 1.6%. The change in overall revenue per kwhr from 1.8¢ in 1948 to 1.85¢ in 1949 reflects the condition.

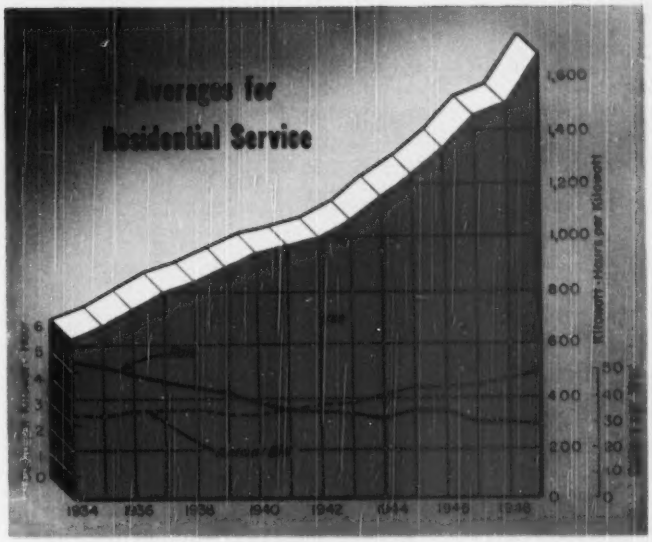
Unit revenue from residential customers in 1949 was 2.96¢, continuing the trend established over many years. Another trend, also long-established, also continued. This is in average annual energy use, which rose from 1,563 in 1948 to 1,685 in 1949, resulting in an annual average bill of $49.88 in 1949, as against $47.05 in 1948. The increase in use of 122 kwhr caused an increase in bill of $2.83. The added use cost the average customer 2.32¢ per kwhr. The comparable figure for 1948 was 2.89¢.

Because of the decrease in use of energy by customers in the

Residential Service
To Urban and Non-Farm Homes

Year	Kwhr per Customer	Average Annual Bill (Dollars)	Revenue per Kwhr (Cents)
1937	805	34.62	4.30
1938	853	35.31	4.14
1939	897	35.88	4.00
1940	952	36.56	3.84
1941	986	36.78	3.73
1942	1,012	37.51	3.67
1943	1,070	38.52	3.60
1944	1,151	40.40	3.51
1945	1,229	41.91	3.41
1946	1,329	42.79	3.22
1947	1,438	44.43	3.09
1948	1,563	47.05	3.01
1949*	1,685	49.88	2.96

Source: Edison Electric Institute. *Estimated.



AVERAGE CONSUMER used 122 kwhr more in 1949 than 1948 and paid $2.83 for them

Large Light and Power class, the unit revenue from them was slightly higher in 1949 than in 1948, 1.05¢ as against 1.01¢. Conversely, the increase in sales to the Small Light and Power customers made a small reduction in the unit revenue from them, 2.67¢ in 1948 and 2.64¢ in 1949.

Percentagewise, the largest 1949 increase in revenue came from Rural customers, as was also the case in respect to energy sales. This group does not include all farm and other rural customers of the electric utilities, but only those served on specific rural rates. Many such customers are served on the same rates as apply in adjacent cities and towns. But the group as classified may be taken as representative and its increased use of electricity as a true indicator of the general condition. In 1949 this group used 17.4% more electricity than in 1948 and paid a bill 13.8% higher. In 1948 the average unit revenue was 2.22¢ and in 1949, 2.16¢.

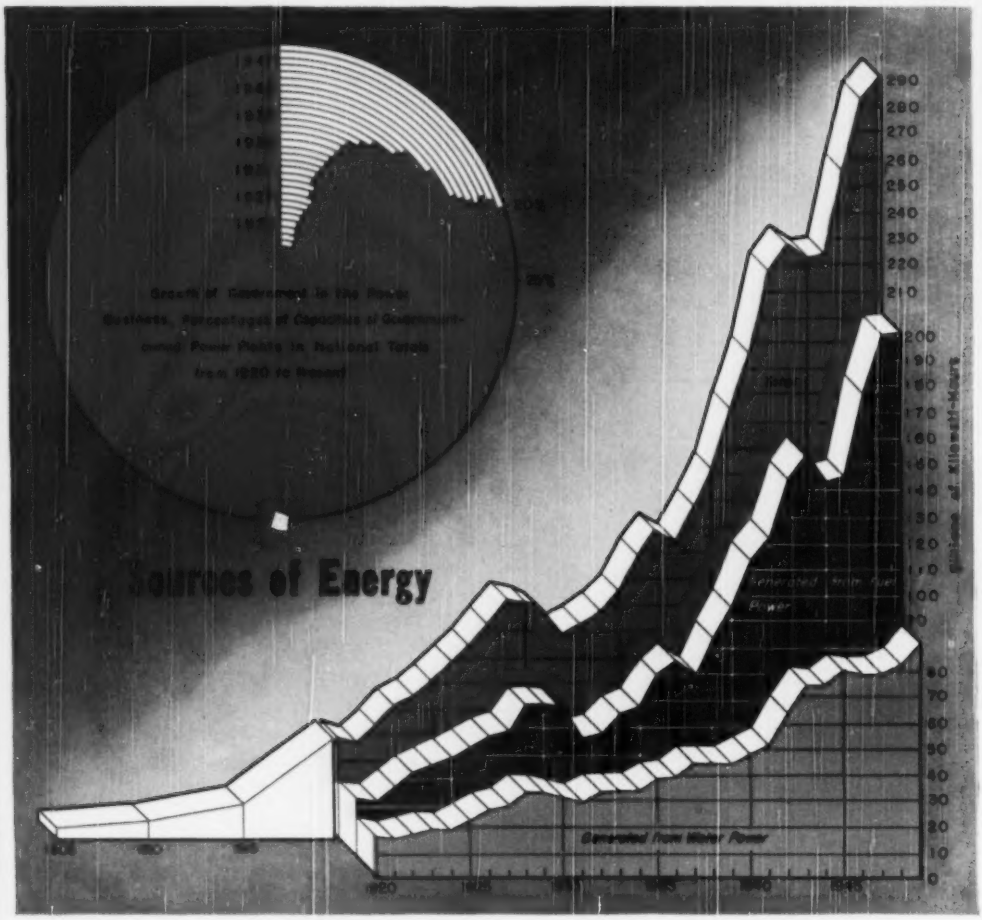
As was the case with energy sales, revenue from street railways and electrified railroads was down in 1949 from 1948. But the reward for effort in street and highway lighting promotion appears in the nearly 10% increase of revenue from this usage.

Revenue from Electricity Sales
(Thousands of Dollars)

Year	Rural ‡	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total from Ultimate Consumers
1935	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937†	37,726	759,824	616,438	583,197	72,740	37,019	10,761	43,091	2,160,798
1938†	38,928	802,532	632,091	518,694	74,323	33,512	11,995	44,504	2,156,580
1939†	45,484	843,158	660,683	572,659	75,443	32,573	14,427	45,154	2,289,583
1940†	49,473	895,951	689,253	631,428	76,052	32,740	15,068	50,252	2,440,218
1941	64,396	938,229	725,117	758,083	76,949	32,471	16,474	53,338	2,665,057
1942	75,027	990,185	767,279	823,318	75,660	35,343	18,289	65,742	2,885,843
1943	76,617	1,029,260	773,678	964,192	75,384	38,278	19,820	100,415	3,077,643
1944	82,842	1,097,726	817,355	1,043,392	76,626	38,672	21,602	98,537	3,276,752
1945	90,344	1,167,356	850,213	1,001,957	76,189	39,787	21,677	93,995	3,341,518
1946	104,876	1,240,577	924,775	969,348	77,570	39,060	21,228	82,125	3,459,560
1947	123,748	1,366,498	1,031,335	1,105,555	78,181	40,160	22,875	83,412	3,852,765
1948	140,648	1,532,663	1,152,783	1,250,684	82,391	39,356	24,195	90,603	4,313,313
1949*	160,000	1,720,000	1,220,000	1,265,000	90,000	37,500	23,500	95,000	4,611,000

Source: Edison Electric Institute. *Estimated. †Uniform System of Accounts prescribed by Federal Power Commission begins new series of figures in 1937. ‡Specific Rural rates only.

Output
290,783,000,000 Kwhr



Small Increase Over 1948

Rapid post-war rise in energy production falters and slows

FOR 1949, output of electric utility power plants was only 2.8% above 1948. Compared with the respective increases of 14.6% and 10.5% for 1947 and 1948 over their previous years, 1949 makes a poor showing. Almost all of the 1949 increase came from water power, 84%, raising its share of output to 30.6% from 29.6% in 1948.

Proportions of output as between power company and government generation remained practically the same in 1949 as in 1948, 79.9% for power companies, 20.1% for government.

Since the smallness of the output increase resulted directly from decline in sale of electricity to manufacturing plants, as appears on another

Source and Disposal of Energy

(In Millions of Kwhr)

Year	Generated from		Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel Power	Water Power						
1935	56,915	38,372	95,287	901	5,669	90,519	12,923	77,596
1936	70,258	39,058	109,316	1,054	5,826	104,544	14,500	90,044
1937	74,900	44,013	118,913	1,733	6,428	114,218	14,859	99,359
1938	69,533	44,279	113,812	1,867	6,990	108,689	14,958	93,731
1939	84,078	43,564	127,642	1,900	7,734	121,808	16,040	105,768
1940	94,516	47,321	141,837	937	7,268	135,506	16,863	118,643
1941	113,925	50,863	164,788	927	6,335	159,380	19,320	140,060
1942	122,108	63,871	185,979	1,448	6,611	180,816	21,409	159,407
1943	144,127	73,632	217,759	1,537	9,729	209,567	24,678	185,889
1944	154,244	73,945	228,189	1,597	6,541	223,245	25,084	198,161
1945	142,516	79,970	222,486	1,773	3,368	220,891	27,333	193,558
1946	144,733	78,397	223,130	1,666	4,576	220,220	29,426	190,794
1947	177,314	78,425	255,739	1,269	6,186	250,822	33,241	217,581
1948	200,228	82,470	282,698	1,113	6,368	277,443	36,703	240,740
1949*	201,525	89,258	290,783	1,050	5,583	286,250	37,500	248,750

Sources: Federal Power Commission and Edison Electric Institute. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. * Estimated

page of this issue, one would expect to note actual reductions in output in regions comprised of highly industrialized states. In the table, "Energy Production by Regions," this is seen to be the case. In both the New England and Middle Atlantic regions output in 1949 was lower than in 1948. And in the East North Central region where much industry is concentrated, the 1949 increase in output was extremely small. This is the first time since the industrial letdown immediately after the war that energy production in any region has dropped below that of the previous year.

Efficiency of electricity production from fuel was higher in 1949 than ever before. The reason appears plainly in the output figures. A very large part of fuel power output came from the new plants and new generating equipment installed in such quantity in the recent past years.

Production of Electric Energy by Ownership

(In Millions of Kwhr)

Year	Privately Owned	Government-Owned		
	Electric Utilities	Local †	Federal	Total Government
1935	89,330	5,403	555	5,958
1936	102,293	5,951	1,072	7,023
1937	110,464	6,606	1,843	8,449
1938	104,090	6,693	3,029	9,722
1939	115,078	7,088	5,476	12,564
1940	125,411	7,842‡	8,584	16,426
1941	144,290	9,705	10,794	20,498
1942	158,052	11,034	16,893	27,928
1943	180,247	13,027	24,484	37,511
1944	185,850	13,473	28,866	42,339
1945	180,926	13,559	28,001	41,560
1946	181,020	15,198	26,960	42,158
1947	208,105	17,757	29,877	47,634
1948	228,231	19,094	35,373	54,467
1949*	232,546	19,921	38,316	58,237

Source: Federal Power Commission.
* Estimated. † Includes municipals, cooperatives, power districts and state projects. ‡ 1940 and following data revised to exclude production by publicly owned transit systems.

Energy Production by Regions

(In Millions of Kwhr)

REGION	1946			1947			1948			1949*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	12,307	3,667	8,640	13,346	3,507	9,838	14,341	3,026	11,315	14,209	3,052	11,157
Mid. Atlantic	47,349	9,382	37,957	53,201	9,658	43,543	57,432	9,064	48,368	56,606	8,847	47,759
E. No. Central	50,069	3,092	46,977	58,879	3,115	55,764	65,141	2,498	62,643	65,985	2,703	63,282
W. No. Central	13,187	2,857	10,330	15,033	2,639	12,394	16,250	2,312	13,939	17,472	2,865	14,607
So. Atlantic	28,551	9,010	19,541	32,266	8,271	23,995	36,089	9,326	26,763	36,812	10,987	25,825
E. So. Central	16,486	13,718	2,768	18,673	12,386	6,287	21,242	13,011	8,231	21,998	16,082	5,916
W. So. Central	13,069	1,448	11,621	15,340	1,151	14,190	17,794	1,022	16,771	19,528	1,378	18,150
Mountain	11,659	9,725	1,934	12,881	10,298	2,583	14,808	11,661	3,147	15,485	11,956	3,529
Pacific	30,501	25,506	4,995	36,120	27,402	8,718	39,601	30,550	9,051	42,688	31,388	11,300
United States	223,178	78,406	144,772	255,739	78,427	177,313	282,698	82,470	200,228	290,783	89,258	201,525

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. * Estimated.

Capacity
61,166,000 Kw

Generating Capacity by Regions
(In Thousands of Kw)

REGION	1946			1947			1948			1949*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	3,188	892	2,295	3,377	894	2,483	3,566	922	2,644	3,732	931	2,801
Mid. Atlantic	10,538	1,591	8,947	10,906	1,584	9,321	11,742	1,590	10,152	12,459	1,592	10,867
E. No. Central	11,575	738	10,837	12,081	741	11,341	12,864	742	12,122	13,961	744	13,217
W. No. Central	3,519	562	2,957	3,669	562	3,107	3,978	564	3,414	4,383	575	3,808
So. Atlantic	6,629	2,221	4,407	6,784	2,221	4,563	7,288	2,221	5,067	7,669	2,223	5,446
E. So. Central	3,425	2,221	1,203	3,561	2,221	1,339	3,741	2,335	1,406	4,021	2,483	1,538
W. So. Central	2,733	385	2,348	2,994	385	2,609	3,358	385	2,973	3,873	385	3,488
Mountain	2,678	2,004	674	2,711	2,021	690	2,852	2,051	801	3,048	2,171	877
Pacific	6,030	4,233	1,797	6,239	4,341	1,898	7,171	4,842	2,329	8,020	5,287	2,733
United States	50,317	14,848	35,468	52,322	14,970	37,351	56,560	15,652	40,908	61,166	16,391	44,775

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. * Data to November 1.

Installed Capacity
(In Thousands of Kw)

Year	Type of Prime Mover		
	Fuel	Water	Total
1935	23,097	9,399	34,436
1936	25,045	10,037	35,082
1937	25,444	10,176	35,620
1938	26,835	10,657	37,492
1939	27,859	11,004	38,863
1940	28,703	11,224	39,927
1941	30,588	11,817	42,405
1942	32,211	12,842	45,053
1943	34,067	13,884	47,951
1944	34,603	14,586	49,189
1945	35,199	14,912	50,111
1946	35,468	14,849	50,317
1947	37,351	14,971	52,322
1948	40,908	15,652	56,560
1949*	44,775	16,391	61,166

Source: Federal Power Commission. * Data to November 1. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad classifications.

Generating Capacity by Ownership
(In Thousands of Kw)

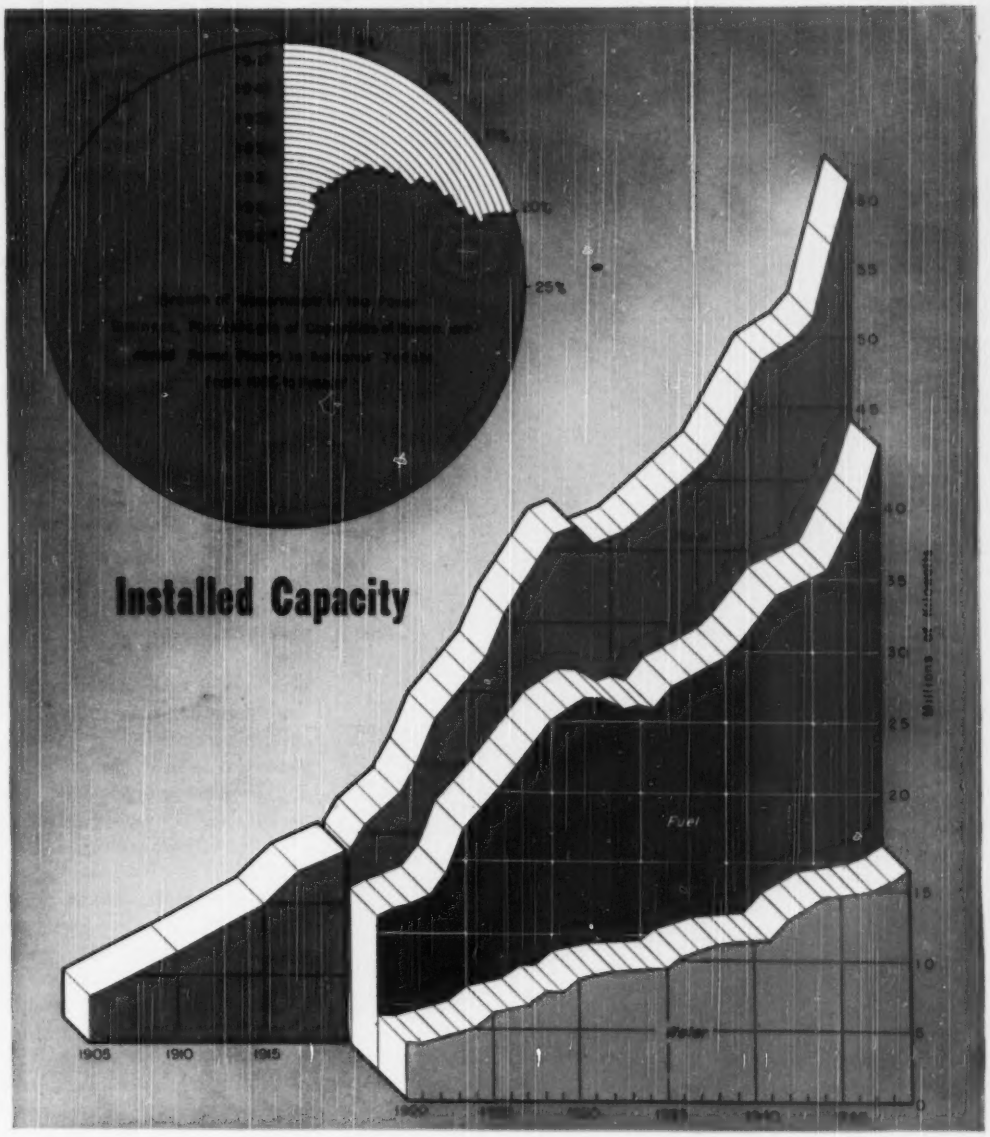
Year	Privately Owned	Government Owned		
	Electric Utilities	Local †	Federal	Total Government
1935	31,820	2,316	300	2,615
1936	31,787	2,491	804	3,295
1937	31,958	2,829	833	3,662
1938	33,246	3,090	1,156	4,246
1939	33,908	3,304	1,650	4,955
1940	34,399	3,584‡	1,944	5,528
1941	36,041	3,933	2,371	6,364
1942	37,442	4,395	3,216	7,611
1943	39,128	4,501	4,322	8,823
1944	39,733	4,570	4,886	9,456
1945	40,307	4,723	5,081	9,804
1946	40,335	5,063	4,920	9,983
1947	41,986	5,308	5,027	10,335
1948	45,381	5,654	5,525	11,179
1949*	48,916	6,156	6,094	12,250

Source: Federal Power Commission. * Data to November 1. † Includes municipals, cooperatives, power districts and state projects. ‡ 1940 and following figures revised to exclude publicly owned transit capacity.

Rate of Capacity Increase

Post-war capacity growth continues at rapid rate, bringing energy supply onto safer ground as reserve margin is widened

MUCH LARGER increase in installed capacity was realized in 1949 than in 1948. This shows in the tables here even though the 1949 figures do not include additions in the



In 1949 Surpasses 1948

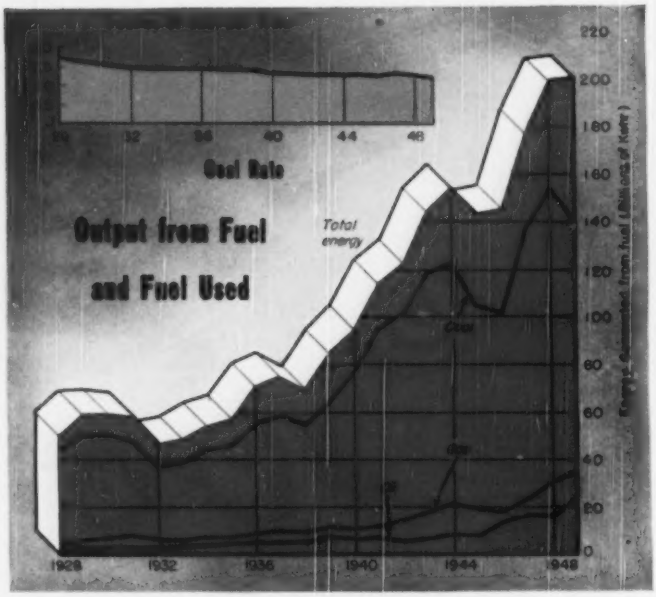
last two months of the year. About 84% of the 1949 increase was in fuel power, the same as in 1948.

Proportion of government in ownership of generating capacity remained about the same in 1949 as in 1948. In 1949 there occurred some shifting among the regions of the country in respect to their order in terms of installed capacity. The South Atlantic and Pacific regions, respectively third and fourth in 1948, changed places in 1949. New England, which ranked seventh in 1948 slipped down to eighth place in 1949.

Station Economics

4,940 Kwhr per Kw

Coal Per Kwhr Sharply Down



OUTPUT FROM COAL dropped 12.9 billion kwhr because of increased hydro generation and because rising coal costs and uncertainty of delivery forced a greater use of gas and oil

Output from Fuel and Fuel Used

Year	Energy Generated From Fuel† (Millions of Kwhr)	Fuel Consumed				
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)	††Coal Equiv. (Millions of Tons)	Pounds of Coal per Kwhr†
1937	74,502	42.93	13.83	169.13	53.56	1.44
1938	69,225	38.39	12.94	165.50	48.56	1.40
1939	83,628	44.54	17.14	188.88	57.60	1.38
1940	93,963	51.47	16.33	180.10	62.94	1.34
1941	113,272	62.67	20.08	201.76	75.70	1.34
1942	121,585	66.26	15.24	235.21	79.08	1.30
1943	143,785	77.30	17.99	301.94	93.27	1.30
1944	153,868	80.08	20.86	358.78	99.25	1.29
1945	142,331	74.72	20.23	326.21	92.64	1.30
1946	144,555	72.20	36.32	306.94	93.47	1.29
1947	176,983	89.53	45.31	373.05	115.67	1.31
1948	199,796	99.59	42.64	478.10	130.12	1.30
1949*	200,991	87.30	58.95	538.95	123.25	1.23

Source: Federal Power Commission. * Twelve months ended October 31. † Output by use of wood not included, except for small amount in 1949. †† Coal plus oil plus gas

TAPERED INCREASE in output in 1949 coupled with a large increment in new generating capacity had two pronounced effects on the economy.

First, the fuel rate has suddenly taken a phenomenally large dip to 1.23 pounds per kwhr.

Second, the tons of coal consumed were down about 5% because of three things—(1) more hydro generation, (2) more consumption of oil and natural gas and (3) more opportunity to use the new efficient generation and let the old take a well needed rest. As a consequence the "diminishing returns" curve has a new discontinuity injected into it like the one when wartime output lead to longer-hour operation of only the best units which were available.

It had taken ten years to lower the Btu and pounds of coal per kwhr by 6% (from 1.38 in 1939 to 1.30 in 1948). But all the favorable factors in 1949 conspired to make a better than 5% decrease in the single year from 1948. The fruits of better combustion efficiency, reduced auxiliary consumption in the new plants and resort to higher steam pressures and temperatures (with considerable reheat) show up in significant gain in thermal economy. A new low in consumption of fuel heat units has set a wholly new goal for future performance.

Higher prices for coal along with higher freight rates have had their inevitable effect on the

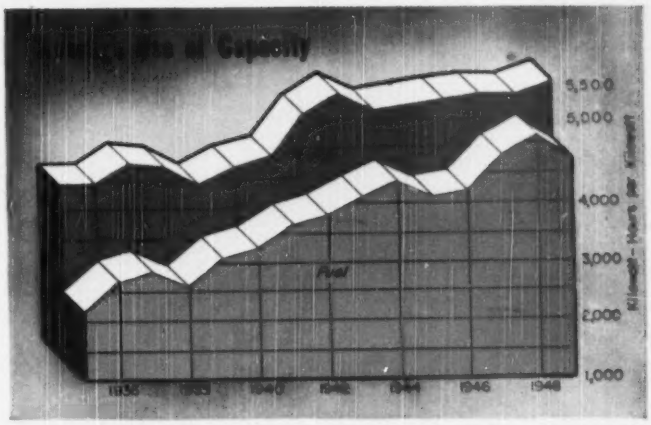
electric utilities. Their bettered plant performance with newly added, highly efficient units could in itself have permitted the purchase of 5% to 6% less coal. Their decrease in use of coal was twice that great. In 1948 utilities had consumed nearly 100 million tons, the largest figure ever. But in 1949 they used only 87.3 million.

Instead, the consumption of oil in the boiler furnaces went up from 42.64 to 58.95 million barrels, an increase of 41%. Present use of fuel oil is nearly a quadrupling over a decade. Somewhat lesser switch to natural gas resulted from the stringencies and cost of coal. The increase in the year was only about 12½% but the present consumption nevertheless is also a quadrupling over the last decade.

At the same time, the year 1949 was making a hydro record that has a bearing on overall consumption of fuel. Kilowatt-hours steam-generated crept up less than ½%—meaning that practically all the 2½% increase in output for the year was borne by the hydro units. The increase in hydro output was over 8% but the increase in installed hydro capacity was less than 5% as the water-power plants were run more hours than ever in their history—5,571. This figure is 34% better than the best that had been achieved up to ten years ago. It means that every kw in every hydro plant was worked hard enough to constitute the equivalent of 65% of the time. The year *must* have been a good-water year to sustain such a record of operation.

Despite the large block of steam capacity added there has so far been little retirement of the older and, naturally, less efficient units. They are manifestly being used less but the industry does not yet feel that the margins of reserve are even now large enough to scrap the old equipment. It is very handy to keep intact for two or three reasons: (1) The load characteristics are changing toward less seasonal difference, leaving less time for overhaul of major units unless the old equipment can take the duty; (2) unexpected peaks or emergencies warrant the old reserves for security. Another year of growth in capacity might perhaps prompt the removal of some of the oldest pieces of generating equipment.

Meanwhile the retirements during 11 months of 1949 totalled only 144,123 kw—only about ¼ of 1%. During the preceding year they were less than a quarter of the 1949 retirements. The day when they will aggregate a normal 2 or 3% seems to be indefinitely deferred. In 1949 the private utilities retired 48,724 kw of steam, 46,473 of hydro and 4,787 of internal combustion. Corresponding municipal and co-op figures were 16,915; 535; and 8,479.

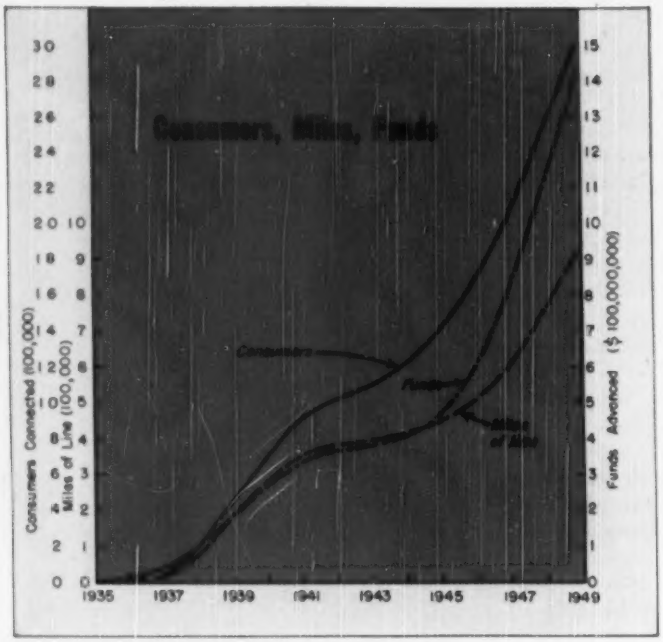


HYDRO CAPACITY generated at full tilt for 5,571 hr throughout the year. A plentiful supply of water enabled hydro to account for almost 84% of the total output increase over 1948

Output, Capacity, Average Use

Year	Energy Generated (Millions of Kwhr)			Generating Capacity at end of year (Thousands of Kw)			Output per Kw Of Ave. Cap. (Kwhr)		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
1936	72,665	39,516	112,181	26,128	10,436	36,564	2,773	3,906	3,089
1937	77,348	44,489	121,837	26,558	10,577	37,135	2,936	4,234	3,306
1938	71,847	44,834	116,681	27,976	11,066	39,042	2,635	4,143	3,063
1939	86,314	44,022	130,336	28,903	11,415	40,318	3,035	3,916	3,285
1940	97,232	47,753	144,985	29,964	11,675	41,639	3,303	4,137	3,538
1941	116,908	51,262	168,170	31,828	12,264	44,092	3,784	4,284	3,923
1942	125,002	64,179	189,181	33,381	13,025	46,407	3,834	5,076	4,181
1943	147,027	73,943	220,970	35,237	14,068	49,305	4,285	5,458	4,617
1944	156,704	74,032	230,736	35,671	14,604	50,275	4,392	5,164	4,634
1945*	142,516	79,970	222,486	35,199	14,912	50,111	4,021	5,419	4,433
1946	144,772	78,406	223,178	35,468	14,849	50,317	4,097	5,262	4,445
1947	177,314	78,425	255,739	37,351	14,971	52,322	4,870	5,442	4,983
1948	200,228	82,470	282,698	40,908	15,652	56,560	5,117	5,386	5,193
1949**	201,525	89,258	290,783	44,775	16,391	61,166	4,704	5,571	4,940

Source: Federal Power Commission. * 1945 and following data revised to exclude former Mining and Manufacturing and Railroad and Railway classifications. ** Estimated.



MORE MONEY was advanced to REA co-ops in the past 3 years than in the preceding 12

Co-ops Are Growing Up

Rising investment per consumer reflects effort to improve service

TOTAL of loans approved by the Rural Electrification Administration now amounts to $1,996,000,000. Of this, advances of $1,432,500,000 have actually been made, an average of $1,344,000 for each of the 993 co-ops and 73 other borrowers now existing. The number of consumers connected is 3,044,000, making the average of funds advanced per consumer $471. This figure of funds per consumer has increased markedly in the three years covered by the table on this page, being $401 in 1947 and

Funds, Miles and Consumers—Cumulative Totals

End of Year	Funds Advanced	Miles of Line	Consumers Connected
1935	$10,000	0	0
1936	3,338,668	3,000	7,508
1937	34,338,022	16,500	43,878
1938	88,344,934	67,409	176,382
1939	184,099,271	181,359	435,566
1940	253,335,726	267,846	674,495
1941	332,033,107	348,062	902,266
1942	364,324,196	378,015	1,012,284
1943	378,496,489	390,058	1,087,801
1944	406,370,722	410,471	1,216,798
1945	463,541,933	449,579	1,408,918
1946	595,730,269	506,838	1,683,901
1947	821,142,824	603,064	2,046,095
1948	1,105,867,987	759,494	2,518,450
1949	1,432,500,000	934,000	3,044,000

Source: REA

$439 in 1948. Part of the reason for this increase is to be seen in the growth of loans approved for generation and transmission.

Average use of energy by consumers on co-op lines is climbing steadily. It was 1,882 kwhr in 1947, 2,084 in 1948, and 2,229 in 1949. For this service, the average consumer paid $61.55 in 1947, $66.35 in 1948, and $71.05 in 1949, which makes the revenue per kwhr 3.27c, 3.19c, and 3.19c in the respective years.

Against this revenue are to be set costs of energy (purchased and generated) and of operations. In terms of the average consumer, total cost of service amounted to $44.42 in 1949. Of this, $24.14 was for energy and $20.28 was for all other operating expenses. For the two previous years of 1948 and 1947, the respective costs were $42.76, $23.17, $19.59 and $38.58, $19.97, $18.61. These figures show a slight growth in cost of service other than for energy supply. This cost covers expenses such as for maintenance, accounting, etc. which do not vary with energy use and its increase is a fairly direct reflection of rise in labor cost.

Rate of growth in miles of line in operation is somewhat slower than of increase in distribution expense. From 1947 to 1948 miles of line rose 25.9% and distribution expense—operating and maintenance—rose 27.1%. The rises, 1948-1949, were 23.1% for line and 28.6% for expense. Again, the cause is probably labor cost.

Indication that co-op lines are spreading out into thinner territory may be said to lie in the figures of miles of line and of numbers of consumers. The data for 1947 show 3.39 consumers per mile; for 1948, 3.32; for 1949, 3.26. However this conclusion may not be justified since the differences between the figures are hardly greater than an allowable margin of statistical error.

Improved loading of system facilities resulting from increased use of energy by consumers is apparent in the declining ratio of energy losses in the three years. Losses were 18.2% in 1947, 17.1% in 1948, and 16.6% in 1949.

The general impression to be taken from the data of the three years presented here is that the period of rapid expansion of co-op systems in terms of area and consumer coverage is coming to an end. This is not to say that the end of co-op system growth is in sight. But the growth is becoming more and more vertical in terms of energy use by consumers and of quality of service, rather than a horizontal spreading out to cover territory.

Operating Data—REA Cooperatives

ITEM	Calendar Year 1947	Calendar Year 1948	Calendar Year 1949[1]
CUMULATIVE YEAR-END DATA			
Total Loans Approved	$1,190,527,346	$1,574,924,461	$1,996,000,000
Distribution Lines	$1,047,753,398	$1,374,738,875	$1,658,500,000
Generation and Transmission	$129,336,475	$186,266,998	$323,000,000
Consumer Facilities	$13,437,473	$13,918,588	$14,500,000
Funds Advanced	$821,142,824	$1,105,867,987	$1,432,500,000
Systems in Operation	911	952	993
Miles of Line in Operation	603,064	759,494	934,000
Consumers Connected	2,046,095	2,518,450	3,044,000
Systems Generating Power During Year	81	96	94
Generating Plants—Kw Capacity	184,050	252,868	335,000
ANNUAL DATA			
Energy Generated—Kwhr	433,282,290	718,282,593	930,000,000
Energy Purchased—Kwhr	3,720,704,812	5,018,725,352	6,506,000,000
Total System Input—Kwhr	4,153,987,102	5,737,007,945	7,436,000,000
Energy Sold—Kwhr	3,398,289,551	4,757,051,392	6,199,000,000
Operating Revenues	$114,787,798[2]	$151,434,599[2]	$197,600,000
Cost of Power[3]	$37,249,806	$52,877,700	$67,150,000
Distribution Expenses—Operations	$8,686,201	$11,072,150	$14,400,000
Distribution Expenses—Maintenance	$5,749,092	$7,272,900	$9,200,000
Consumers Accounting and Collecting	$4,398,167	$5,856,880	$7,600,000
All Other Operating Expenses	$15,861,663	$20,503,639	$25,200,000
Total Operating Expenses	$71,944,929	$97,583,269	$123,550,000
Net Non-Operating Margin	$714,330	$754,462	$700,000
Interest Expenses	$11,053,861	$14,803,674	$19,800,000
Net Revenue Before Depreciation	$32,417,097[4]	$39,691,386[4]	$54,950,000
Depreciation	$18,015,316	$24,906,720	$35,350,000
Net Margin After Depreciation	$14,401,781	$14,784,666	$19,600,000
PAYMENTS TO GOVERNMENT—CUMULATIVE DATA			
Interest Due	$67,694,647	$78,704,029	$92,250,000
Interest Paid	$67,177,360	$78,206,085	$91,850,000
Principal Due	$63,870,633	$88,442,643	$112,250,000
Principal Paid	$86,695,023	$106,319,234	$131,550,000
Overdue Amounts—More than 30 days	$949,229	$958,768	$910,000
a. Interest	$577,474	$449,381	$330,000
b. Principal	$371,755	$509,387	$580,000
Advance Payments of Principal	$23,282,077	$18,475,888	$20,000,000

Source of Data: Monthly Operating Reports of REA borrowers and records of the REA.

[1] Based on nine (9) months actual data and one (1) to three (3) months estimated.

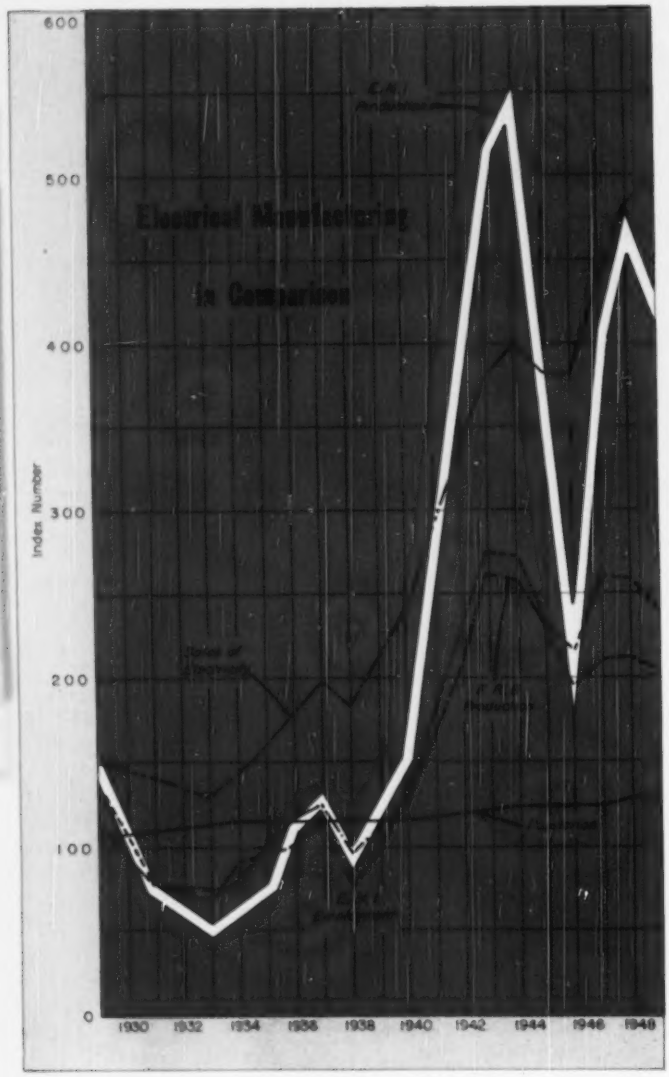
[2] Cost of Power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.

[3] Does not include revenues reported by REA borrowers from whom figures for other items were not available: $210,308 for 17 borrowers for 1947 and $239,198 for 6 borrowers for 1948.

[4] After deducting miscellaneous revenue deductions not shown separately: $86,241 for 1947 and $110,732 for 1948.

1949 Production Under 1948

Last year's decline in appliance sales pulls production index down

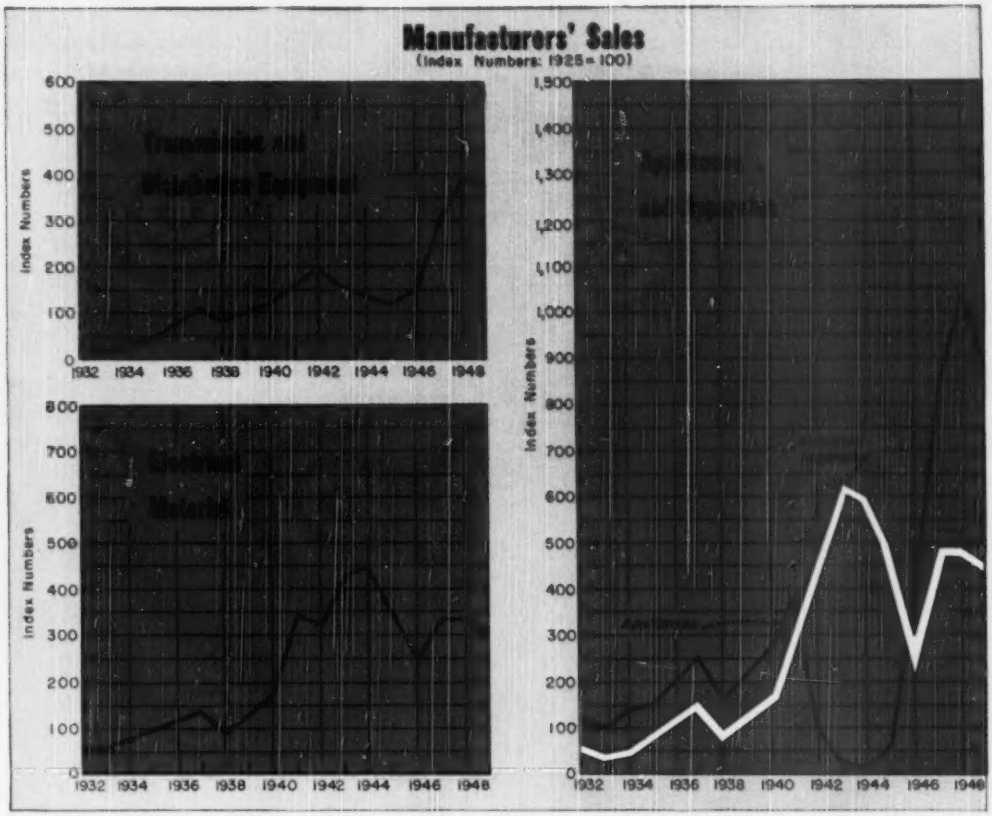


PRODUCTION in the electrical manufacturing industry dropped 48 points in 1949, due to a decline in the first six months in the sale of practically all appliances except television sets

PRODUCTION of the electrical manufacturing industry declined in 1949 about 10% from 1948, according to the table of indexes on the page opposite. This was a larger drop than in general manufacturing which was about 4%, as shown by the decline in the Federal Reserve Board production index from 211 to 203.

Major cause of the larger reduction in the EMI production index was undoubtedly the precipitate drop in appliance sales in the spring and summer of 1949. With the outstanding exception of television, according to data in the January, 1950, "Electrical Merchandising" practically all appliance sales were off in 1949, some, like ranges and water heaters, as much as 35% down from 1948.

Elsewhere in this issue appear estimates of capital expenditures of electric utilities. These figures show a large increase, 1948 over 1947, in transmission and distribution construction which is corrobated by the rise in the transmission and distribution apparatus index in 1948. But this index shows a decline of about 4% in 1949 while the T&D capital expenditure estimates went up about 9% in that year. Reduction in inventories by utilities of about 12% disclosed by a recent ELECTRICAL WORLD study is said to be a solution to this paradox.



Indexes of Electrical Manufacturing 1925 = 100

YEAR	The Industry and Related Factors					Sales of Electrical Products			
	1 E.M.I. Production	2 E.M.I. Employment	3 F.R.B. Production	4 Sales of Electricity	5 Population	6 Appliances	7 Electrical Material	8 Industrial Apparatus	9 Trans. & Dist. Apparatus
1929	156	137	121	150	106	178	135	149	130
1939	123	98	120	212	114	229	116	127	104
1940	154	129	137	238	115	273	149	177	124
1941	276	189	178	281	116	376	253	317	189
1942	415	228	219	319	117	93	318	465	213
1943	522	252	263	372	119	27	447	638	167
1944	553	271	258	396	120	17	453	633	141
1945	390	238	223	387	122	73	343	455	138
1946	258	212	187	382	123	395	253	295	153
1947	415	262	205	435	125	867	339	495	309
1948	477	259	215	481	128	1040	339	482	399
1949*	459	238	203	500	130	885	305	464	383

Source: NEMA. *Estimated.

1. E.M.I. PRODUCTION reflects total production in the electrical manufacturing industry, which industry is considered to cover not only those products commonly referred to as Electrical Machinery, Apparatus and Supplies, but also all electric appliances including washing machines, vacuum cleaners, household refrigeration equipment, commercial refrigeration equipment, air conditioning equipment, lighting fixtures, insulating materials, radio apparatus and supplies, automotive electrical equipment, steam turbines for electrical driv:, bare copper wire, and mining and industrial electric locomotives. Production of non-electrical equipment within the industry is also included for the war and post-war years.

2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925 = 100. This series represents the electrical manufacturing industry including radio and includes latest revision to Census figures made by N.I.C.B. Recently, however, the N.I.C.B. Index was discontinued and therefore the 1948 and 1949 figures represent an extension of the 1947 figure based upon the B.L.S. Employment Index of Production Workers in the Electric Machinery Manufacturing Industry.

3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for total industrial production, unadjusted, and adjusted to 1925 = 100. (includes all revisions made by F.R.B. up to December 15, 1943.)

4. ELECTRIC POWER SALES index figures based upon E.E.I. data.

5. POPULATION based upon the annual mid-year estimates of the U. S. Bureau of the Census.

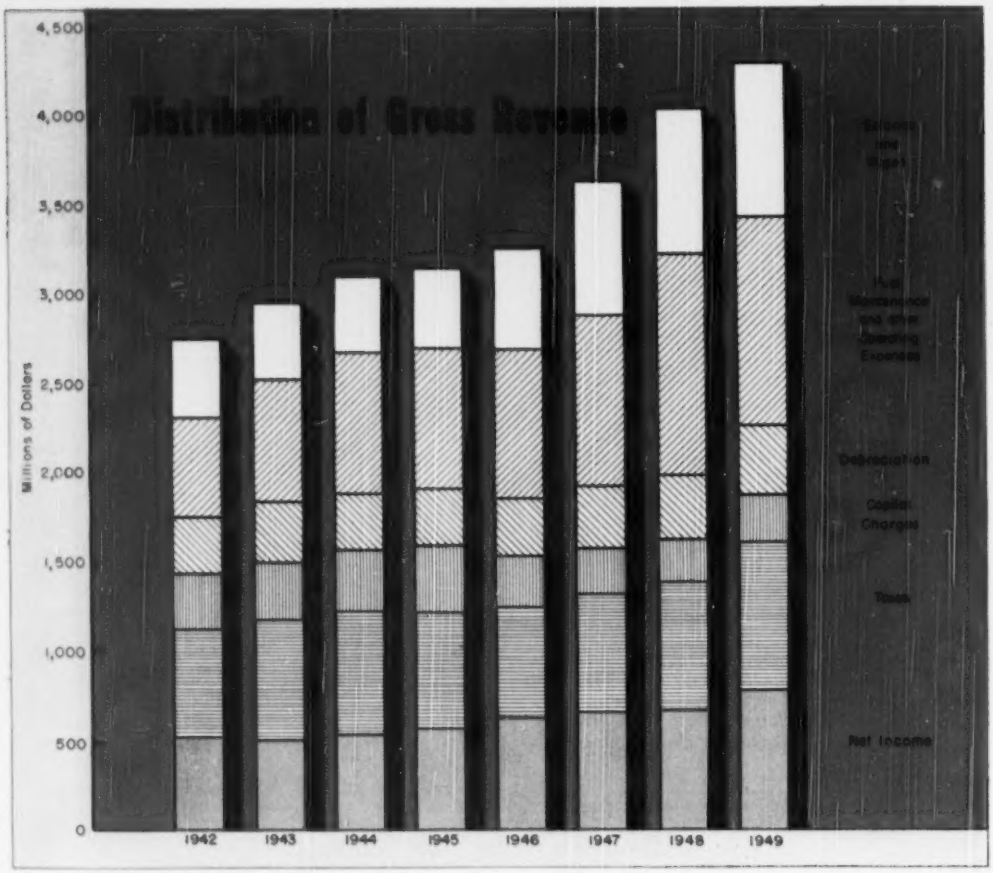
6. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans, food service equipment, and household refrigerators, complete units, parts and cabinets. All commercial refrigeration equipment and air-conditioning equipment are excluded.

7. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

8. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.

9. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and watthour and demand meters.

All indexes based upon U. S. Census of Manufacturers data and NEMA statistical department data corrected where possible to represent the entire industry.



Utility Net Income Rises

Reduction in fuel costs is major factor in increase

EARNINGS of electric utilities showed a striking improvement in 1949. Electric revenues increased $250 million. But operating expenses went up only $4 million and total revenue deductions only $122 million. The result was 16% more net income than in 1948.

The 6.3% gain in revenues was smaller than the 11% rise achieved in 1947 and in 1948. Only part of the increase was due to kilowatt-hour sales, which were little above 1948 in the closing months. Rate increases and shifts in type of service also boosted the revenue total. Kilowatt-hours sold to Residential customers grew by 15% while the amount of power sold at low rates to Large Light and Power consumers actually dropped.

Costs levelled out too. The 6.3% rise in electric revenues more than matched the rise in wages, salaries and "other" oper-

ating expenses during the year. Both wages paid by electric utilities and prices for materials bought by the power companies rose less than in 1948. This reflected the generally lower pressure on prices and wages throughout the economy.

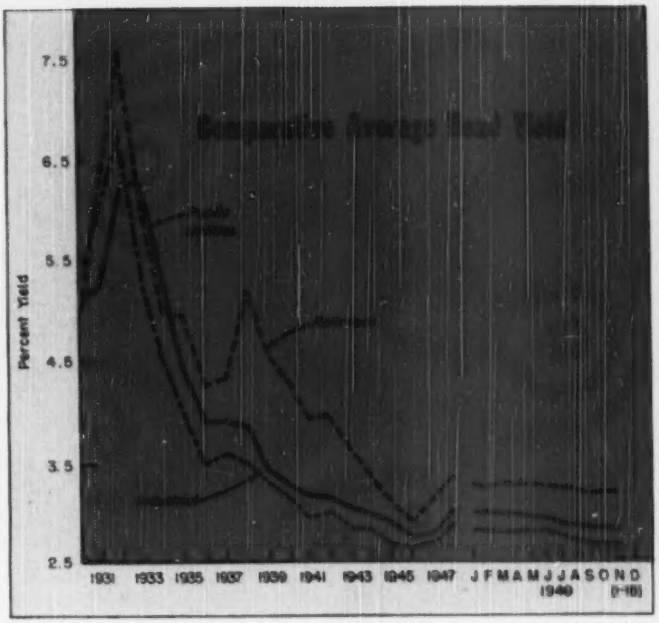
But the decisive item in improving utility earnings was the reduction in fuel costs. Water conditions were more normal than in 1948 and use of stand-by steam generating capacity less. The new capacity added by the industry proved much more economical in its use of coal. Consequently, the average amount of coal burned per kilowatt-hour generated was 7½% less than in 1948. Although power output was up and coal prices averaged slightly higher, the industry's fuel bill dropped 9%.

Fuel took only 16.5% of the revenue dollar or about the same share as in 1947, compared with 19.5% in 1948. As other expenses rose only slightly less than revenues, it was the drop in fuel costs that brought total operating expenses down to 49% of total revenues.

Partly offsetting the gain in operating profit was a sharp rise in the power companies' tax bill. Federal income taxes particularly went up right along with earnings. And more money had to be paid local tax authorities to cover assessments on increased property valuations.

Non-operating income improved. The gas, water and steam departments of utilities also won rate increases which increased their contributions in 1949. This more than offset the loss on income from securities held. Total income available to bondholders and stockholders was 15% above the previous year.

The need for this substantial



DECLINING AVERAGE YIELD of electric utility bonds in 1949 parallels the trend of industrials. This yield is an indication of favorable position of utility bonds in the market

Composite Year-End Balance Sheet
Electric Utility Companies
(Class A and B)

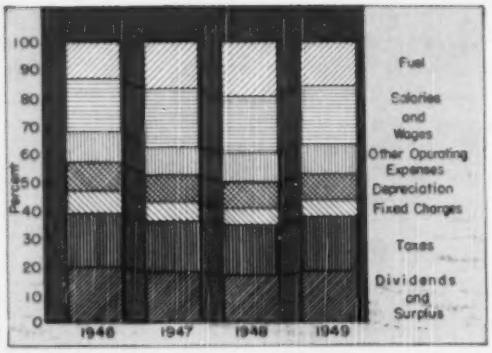
	Millions of Dollars		
	1948	1947	1946
ASSETS:			
Electric Plant and Adjustments	15,513	13,671	12,422
Gas Plant and Adjustments*	.....	1,449	1,359
Other Utility Plant and Adjustments	2,244	515	482
Unclassified and Undistributed*	.....	454	689
Total Utility Plant	17,757	16,029	14,952
Investment and Fund Accounts	1,155	1,096	1,067
Current and Accrued Assets	1,985	1,786	1,727
Deferred Debits	227	256	254
Capital Stock Discount and Expenses	35	33	34
Reacquired Securities	46	57	50
Total Assets	21,204	19,258	18,083
LIABILITIES:			
Capital Stock	6,590	6,224	5,939
Long Term Debt	7,719	6,601	6,150
Current and Accrued Liabilities	1,360	1,203	1,003
Reserve for Depreciation and Amortization of Utility Plant	3,859	3,572	3,327
Other Reserves	100	198	244
Deferred Credits	112	118	112
Contributions in Aid of Construction	55	49	46
Surplus	1,411	1,292	1,262
Total Liabilities	21,206	19,258	18,083

Source: Federal Power Commission.
* These classifications discontinued in 1949. All plant is now classified as "electric" or "other."

Distribution of Revenue Dollar
(Percentage)

	1946	1947	1948	1949*
Fuel	13.1	16.4	19.3	16.5
Salaries and Wages	18.5	20.6	20.4	20.3
Other Operating Expenses	10.9	10.2	10.6	10.6
Depreciation	9.9	9.4	9.1	9.1
Fixed Charges	8.0	6.8	6.1	6.4
Taxes	19.6	18.4	17.8	18.9
Dividends and Surplus	20.0	18.2	16.7	18.2
	100.0	100.0	100.0	100.0

* Estimated.
Source: Federal Power Commission and Edison Electric Institute



NET AVAILABLE for dividends and surplus recovered a little in 1949 after declining steadily in the two previous years

gain was reflected in the heavy payments required on electric utility securities. Neither interest rates nor dividend rates changed significantly during the year. But total interest paid was up almost 16%. Preferred stock dividends totalled 5% more than in 1948. And common stock dividends rose 15.4%. The tremendous increase in securities outstanding accounts for these higher disbursements.

Some of this increase is shown by the year-end balance sheet for 1948. The higher value of investment in utility plant is what necessitated higher charges for depreciation, interest and dividends in 1949. Total utility plant investment was up more than 10% in 1948 over the 1947 figure.

Balance sheet figures for 1949 are not yet available. But it is a matter of record that the industry added about $1.8 billion to plant account and issued over $1.4 billion of new money securities during the year. About 40% of this new capital was raised by sale of common and preferred stocks. However, at the year's end the ratio of debt to total capitalization was still about 49%. This makes it clearly desirable that a high proportion of equity financing be maintained.

Composite Income Statement
Electric Light and Power Companies
(Millions of Dollars)

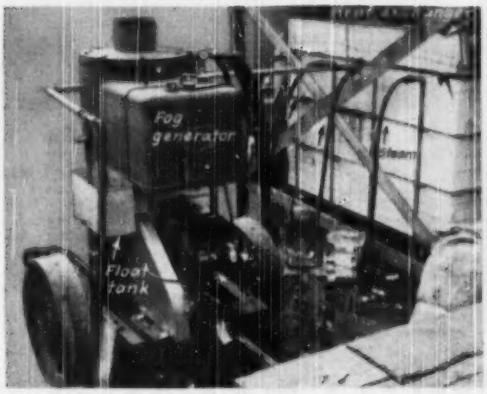
	1941	1945	1946	1947	1948	1949*
Total Electric Revenue	**2,467**	**3,012**	**3,127**	**3,480**	**3,903**	**4,150**
Operating Expenses	947	1,259	1,385	1,701	2,026	2,030
Depreciation	279	322	324	339	366	390
Total Expenses	**1,226**	**1,581**	**1,709**	**2,040**	**2,392**	**2,420**
Electric Operating Income before Taxes	**1,241**	**1,431**	**1,418**	**1,440**	**1,511**	**1,730**
Taxes	520	652	639	664	716	810
Electric Operating Income after Taxes	**721**	**779**	**779**	**776**	**795**	**920**
Other Income (1)	128	126	130	125	119	130
Gross Corporate Income	**849**	**905**	**909**	**901**	**914**	**1,050**
Capital Charges (2)	312	360	259	245	244	272
Net Income	**537**	**545**	**650**	**656**	**670**	**778**
Of Which:						
To Dividends	437	415	467	504	503	570
To Surplus	100	130	183	152	167	208

Source: Federal Power Commission and Edison Electric Institute.
* Estimated.
(1) Includes revenues of gas, water and steam departments and interest on securities held.
(2) Includes amortization and interest on long-term debt.

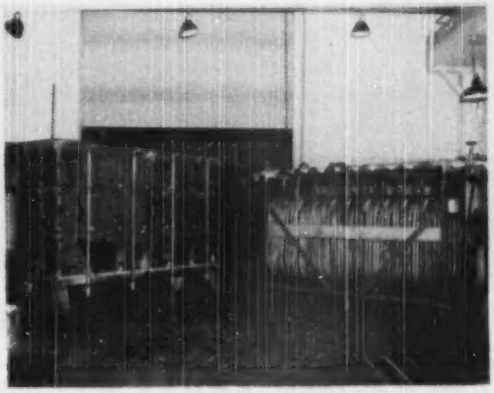
Security Sales by Classes
(In Thousands of Dollars)

Year	Bonds, Debentures, etc. to		Stocks, Common and pfd.	Total Financing	Distribution of Security Sales		
	Public Investors	Institutional Investors			New Capital	Refunding	Total Issues
1935	957,042	110,629	8,229	1,075,900	26,496	1,049,404	1,075,900
1936	1,122,800	156,881	52,259	1,331,940	59,727	1,272,213	1,331,940
1937	522,613	37,604	86,095	646,312	81,984	563,699	645,682
1938	750,549	192,762	20,694	964,005	123,056	840,949	964,005
1939	620,205	252,625	123,517	996,347	16,219	980,128	996,347
1940	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941	368,712	255,915	116,208	740,832	97,065	643,767	740,832
1942	226,800	99,688	29,766	356,254	92,666	263,588	356,254
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,253	1,361,922
1946	633,966	64,040	384,441	1,082,447	172,846	909,601	1,082,447
1947	1,039,517	153,159	384,699	1,577,375	567,729	1,009,646	1,577,375
1948	996,641	156,525	297,460	1,450,626	1,314,456	136,170	1,450,626
1949	959,978	192,280	640,953	1,793,211	1,444,826	348,385	1,793,211

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN



SURPLUS FOG GENERATOR supplies live steam through four hoses and pipes to heat exchanger (right) used to dry out large transformers. Float tank mixes exchanger tank overflow and cold water



STEEL TANK with four bottom nozzles supplied by four vertical pipes (left) and set of ten heat-exchanger coils (right) connected to intake and exhaust manifolds. Transformer oil is circulated through coils

Converted Fog Generator Dries Transformers

ARTHUR F. WETSCH
Chief, General Shop Unit
Bonneville Power Administration
Portland Ore.

ADAPTATION of a Navy surplus fog generator as a source of steam for a heat exchanger has saved Bonneville Power Administration several thousand dollars in drying out large transformers. Equally important is the vastly increased safety and ease of operation of the unit compared with methods previously used for this purpose.

The heat exchanger is a set of ten coils of copper tubing connected in parallel to 2½-in. intake and exhaust manifolds. These coils are set in an insulated, vented, steel tank. Oil to be heated is pumped through the copper coils and heated by hot water surrounding them. The water is heated by steam introduced at the bottom of the tank through a multiple nozzle at the end of each of four steam lines from the steam generator. Direct contact of hot air or steam on the coils would result in charring of the transil oil.

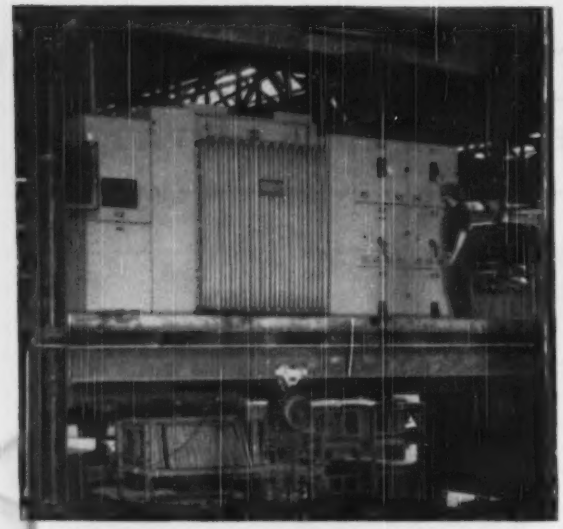
Steam is generated by a Navy type SCL fog generator that burns diesel-oil to heat water flowing through steel tubes. The entire burning unit is enclosed in a brick and asbestos-lined fire pot surrounded by a steel jacket, eliminating any open flame. The heat exchanger is under no pressure, and is located several feet away from the oil burner in operation, further decreasing any remote danger of igniting the oil being heated.

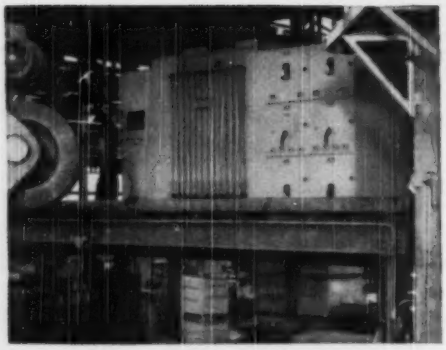
Average length of time to bring oil in a 50,000-kva transformer up to heat (180 F) on test was 48 hrs. The total diesel oil consumption was about 350 gallons. On similar transformers where gasoline burners were used to heat the exchanger tank directly, substantially more hours per transformer were required, and several thousand gallons of gasoline consumed. It also required several men, compared to one for the new unit, and the burners had to be replaced so often it was necessary to manufacture several extras for use as standbys. Lower cost of diesel fuel, coupled with the substantial reduction in man-hours added up to savings of more than $1,500 for each transformer bank.

Normal operation is to keep steam temperature between 250 and 300 F at a pressure of 30 psi. A popoff valve set at 100 psi protects the system against explosion. Temperature is regulated by manipulating the valve in the fuel oil line. After the equipment is in operation, this is the only control required.

Steam enters the heat exchanger tank through four hoses that terminate in a "crow's foot" containing many small jets. Steam upon striking water in the heat exchanger is immediately condensed to water, giving up its latent heat of vaporization.

A float tank mounted on the side of the burner recirculates the hot water from the heat exchanger, controlling the flow of water to the burner tubes. A hose return from the top of the heat exchanger transports the overflow from the heat exchanger tank back to





ALL UNIT SUBSTATIONS MOUNTED ON PLATFORMS TO SAVE FLOOR SPACE

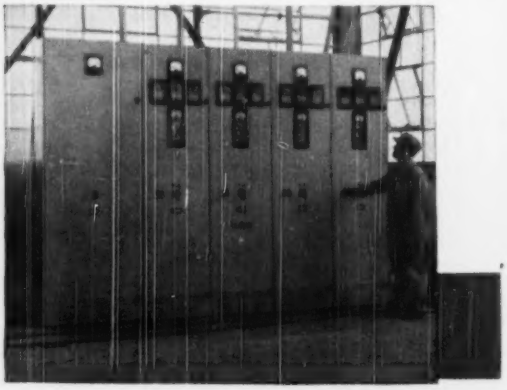
Two views of General Electric 1000-kva load-center unit substation at new Maytag plant. Valuable manufacturing space is saved by locating units on platforms under the roof, right over the center of the load area. Air switch on primary is easy to operate, contacts are easy to see. Air circuit breakers on secondary are of the drawout type, easily removable for inspection and maintenance. Note entire load center is metal enclosed, thus offering operating safety to personnel.

LOAD-CENTER

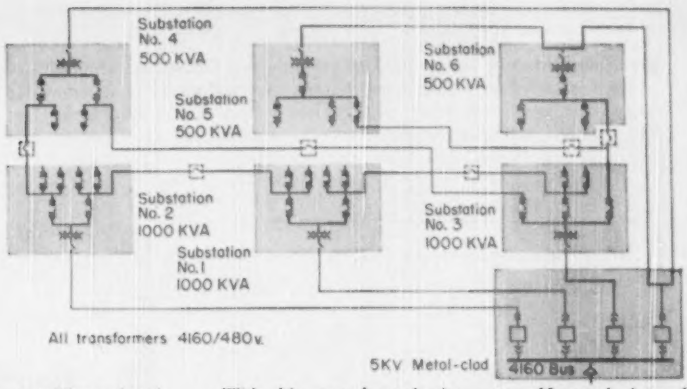
UNIT SUBSTATIONS

Unit substation No. 5, rated 500 kva. Air circuit breaker for future circuit can be inserted in empty upper housing. Drawout breakers are G-E Type AK-1 with 25,000 ampere interrupting rating—plenty of "IC" (Interrupting Capacity) to handle all short circuits. Contacts of 5 kv air switch are clearly visible through window, another safety feature of G-E substations.

G-E 5-kv metal-clad switchgear handles 4160 volts incoming power, distributes it to six load-center unit substations where it is stepped down to 480 volts for utilization. Metal-clad switchgear is neat in appearance, saving in space, and offers safety to operating personnel. Additional sections can be added for future expansion with a minimum of bother and expense.



CONTINUOUS POWER ASSURED MAYTAG BY SECONDARY-SELECTIVE DISTRIBUTION SYSTEM


Substation No. 4 500 KVA
Substation No. 5 500 KVA
Substation No. 6 500 KVA
Substation No. 2 1000 KVA
Substation No. 1 1000 KVA
Substation No. 3 1000 KVA
All transformers 4160/480v.
5KV Metal-clad
4160 Bus

This secondary-selective system at the new Maytag installation uses General Electric metal-clad switchgear to handle the incoming 4160 volts through four magne-blast power circuit breakers. Feeders distribute the 4160-volt power to six G-E load-center unit substations throughout the building where the high-voltage is stepped down to 480 volts for utilization—right at the center of the load area. This eliminates long, costly secondary feeders. Air switches on the primary of all load centers are rated 5 kv. Key interlocks give operating safety to personnel by preventing breaking of the load current with the air switch, or paralleling transformers.

With this secondary-selective system Maytag is insured against a power shutdown in case of failure of any one transformer or its primary feeder cable. If trouble occurs the normally open tie breaker is closed, thus providing an alternate source of power that permits the plant to operate at slightly reduced capacity.

The Maytag installation is a complete General Electric project—one source of responsibility plus the very best in coordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

HELP SPEED PRODUCTION AT THE NEW *Maytag* PLANT AT NEWTON, IOWA

ONLY G-E LOAD CENTERS GIVE YOU THESE FEATURES . . . .

SELECTED STANDARD ratings have been introduced by General Electric to bring you load centers on 20 per cent shorter shipments. The most popular are—

Low voltage	480 △ or Y, 208Y/120 volts
High voltage	2.4, 4.16, 4.8, 12, 13.2, 13.8 kv, delta
Kva ratings	300, 500, 750, 1000, 1500, 2000

Certain other *selected standard* load centers are available. Contact your G-E sales representative for further information.

NEAT APPEARANCE . . . Note the smooth, integrated appearance of these G-E unit substations . . . no more gawky, "old-type" stovepipe connections between transformer and switchgear.

SAVE TIME by eliminating weeks spent over drawing boards detailing individual items. G-E factory-assembled unit substations are quickly and easily installed with lower material and labor costs than required for "piece-meal," makeshift affairs. No last minute "alterations" with hacksaws and cold chisels to make them fit.

INVESTIGATE TODAY how General Electric unit substations can be used in your plant for efficient, flexible power distribution. Contact your G-E sales representative for further information, and write today for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3592	Load-center Unit Substations
GEA-3758	Load-center Power Distribution
GEA-3083	Metal-clad Switchgear
GEA-4057	Interlocked-armor Cable for Primary Circuits
GEA-4352	Flamenol Cable for Secondary Circuits

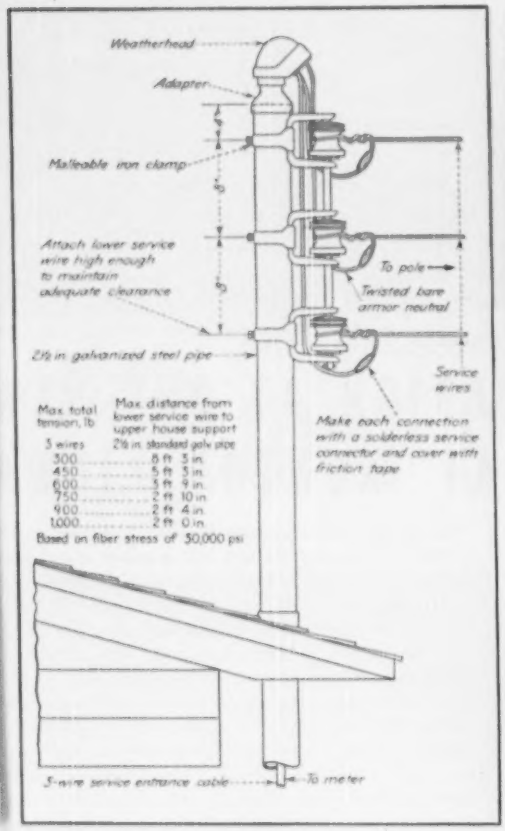
"For our new plant that manufactures Maytag automatic washers, we wanted the very best in power distribution systems. That's why we chose a secondary-selective system using General Electric load-center unit substations. We found that a system such as this would be more economical than any other type. Even though the initial cost was slightly higher than a simple radial system, the fact that we were assured of continuous power for our manufacturing facilities, even though a transformer or feeder cable should drop out, meant that we would save time and money in the long run. We also chose a load-center system because we can easily expand it to take care of any increase in our manufacturing facilities. We also bought 'standard' unit substations because we discovered they would do the job just as well as 'specials'—and at far less cost—and because we could get better delivery. After the units arrived they were installed on the platforms and were operating in a very short time. And dealing with one organization saved us time and money because we could get the engineering, equipment, and service all from one reliable source."

L. C. McAnly, Sr., Manager of Manufacturing,
The Maytag Co., Newton, Iowa

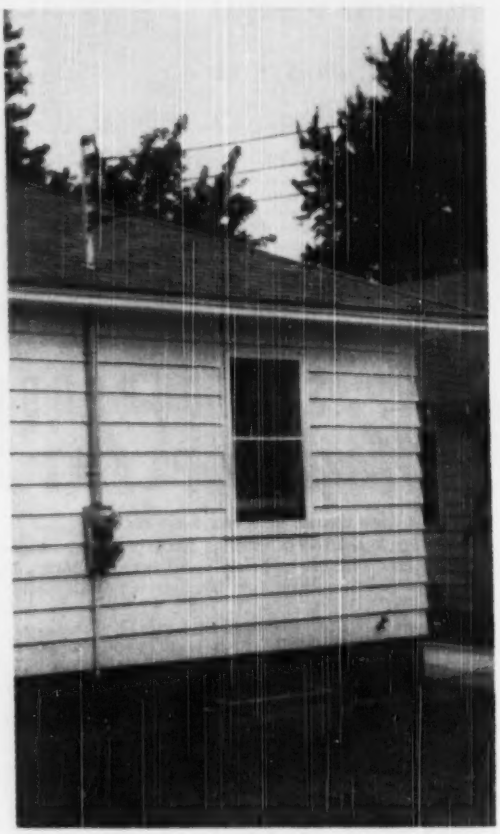
Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

GENERAL ELECTRIC

the burner. Another hose, connected to the float tank from the main water supply line, supplies make-up water. Thus, a mixture of hot and cold water can be run through the coils back to the heat exchanger. This allows for fine temperature control in leveling off, and permits pumping of cold water through the burner coils into the heat exchanger in order to bring down the temperature, should it become too high.


Weatherhead
Adapter
Malleable iron clamp
Attach lower service wire high enough to maintain adequate clearance
To pole
Twisted bare armor neutral
2½ in. galvanized steel pipe
Service wires
Make each connection with a solderless service connector and cover with friction tape
Max. total tension, lb
Max. distance from lower service wire to upper house support
3 wires
2½ in. standard galv pipe
300 ..... 8 ft 3 in.
450 ..... 5 ft 3 in.
600 ..... 3 ft 9 in.
750 ..... 2 ft 10 in.
900 ..... 2 ft 4 in.
1,000 ..... 2 ft 0 in.
Based on fiber stress of 30,000 psi
3-wire service entrance cable
To meter

SUPPORTS pass through the building cornice and act as conduit to carry service entrance cable with metallic interlocking armor



TWO-INCH hollow square section is one of the types of support which goes through building cornice, presenting neat appearance

A Service Wire Support for Low Buildings

W. C. SCHMIDT
Overhead Line Engineer
Consumers Power Co
Jackson, Mich.

To solve the problem of supporting service wires to low, ranch-type houses, Consumers Power Co developed, cooperatively with manufacturers, a galvanized metal device that provides ample strength and is also neat in appearance. It serves as both support for service wires and conduit service entrance cable.

There are two variations of design. One is a 2½-in. galvanized pipe, and the other a 2-in. hollow square steel section. Each, complete with weatherhead, insulators, fastenings, etc, is supplied as a unit by the manufacturer. The pipe support is made by the Electrical Manufacturing Co of Battle Creek, Mich., and the square section support is manufactured by Edward J. Fisher, also of Battle Creek, Mich.

For those customers who feel they cannot afford to purchase the packaged steel support, the company recommends the use of a 4x4 in. or 4x6 in. wood support, depending on length of service wires, with auxiliary conduits and fastening.

To discourage energy theft at locations where the conduit or metal support goes through the building cornice, the company specifies use of service entrance cable with metallic interlocking armor.

HERE ARE ALL THE FACTS ON RM* POWER TRANSFORMERS

*Certain G-E power transformers, within the complete G-E line, have for a number of years been designated as "repetitive manufacture," or "RM" for short. These are standard transformers—that lend themselves to quantity production.

Through quantity production RM transformers can be built faster, at lower cost. Engineering and drafting for any particular transformer is already done—component parts can be mass-produced—jigs and fixtures are already on hand.

As a result, RM transformers can be delivered months sooner than non-RM transformers. Their prices are lower, by at least eight per cent, than specials of identical ratings.

"RM" transformers are available in ratings of 667 to 5000 kva, single-phase, and 750 to 10,000 kva, three-phase and with high voltages in accordance with EEI-NEMA preferred voltage ratings between 2400 and 67,000 volts. They are equipped with the most popular types of terminals and accessories.

A NEW 44 page catalog gives you

Prices • Ratings

Electrical and mechanical data

Application and selection data

Lists and descriptions of basic accessories and optional features

If you haven't received your copy of GEC-479, call your local G-E office or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

what's **New** in street lighting

These are important tools for your 1950 street-lighting program. They are the improvements which General Electric has introduced in lighting equipment during the last 12 months.

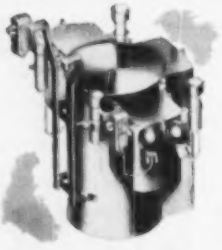
Although these developments have been previously announced, we suggest that you review them again. If there are any that you want to know more about, please call or write us.

8 Important

for better street-lighting

FLUORESCENT LUMINAIRES FOR ROADWAY LIGHTING. This is the first line optically designed for roadway lighting. They offer many proven advantages together with a few obstacles to be overcome. General Electric has developed units for overhead street lighting, fence-height lighting of bridges or viaducts and continuous-strip tunnel lighting. Optically they are correct. Units are available for pioneer installations.

EFFECTIVE LUMINAIRE FOR LARGE LAMPS. With 15,000 lumen filament lamps, the Form 109 brings a new effectiveness to street lighting. The secret lies in a new G-E ovate reflector with its beam-spreading triple-lateral principle. Glare is reduced three ways. (1) Deep-shielded light source, (2) Large low-intensity refractor, and (3) Extremely accurate control of light by the balanced operation of the ovate reflector and Holophane Verti-lateral refractor.



CUTS INSTALLATION COSTS BY ⅓. This new General Electric outdoor substation-type constant-current regulator has all of its component parts interwired at the factory. In the field it is only necessary to bolt it on the pole or platform—connect the power and control leads. All components are in one location, yet each is readily accessible—in its own oil. And it's safer—the fuse-cutouts are located where they give positive visible assurance that the circuit is open.

HIGH-EFFICIENCY RESIDENTIAL OPTICAL ASSEMBLY. The new Type RV optical assembly offers a high-efficiency unit for safe, attractive lighting of residential or light-traffic streets at a price even modest budgets can afford. It produces a long, narrow, two beam distribution (IES Type 1), making it excellent for very long spacing (10 to 12 times mounting height). It can be mounted on any Form 79 or 101 hood.

NOW INDIVIDUALLY TESTED FILM CUTOUTS. A new G-E automatic tester actually tests each film cutout for shorts and insulation values—individually—before it is packaged. Starting with cutouts of known breakdown available in correct ratings, designed for high temperature and pressure conditions, G.E. has produced even a better film cutout without any increase in price.

MULTIPLE SWITCH THAT PLUGS INTO METER SOCKET. Here's a multiple switch that plugs into a standard watthour meter socket. It has all components permanently wired on a molded base. For easy maintenance, the socket is jack-mounted. A glass watthour meter cover protects the elements yet affords quick inspection. These features help you stretch those short maintenance dollars.

Developments at lower cost of 49

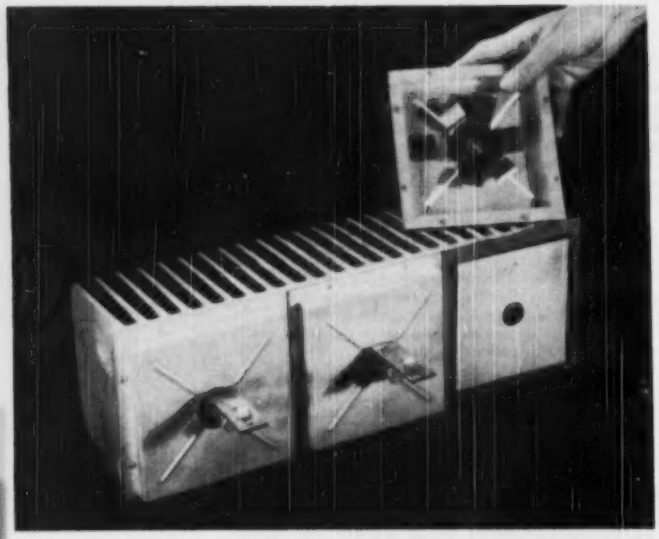
NEW CLAMP BAND SUPPORTS OPTICAL ASSEMBLIES. Here is a better way to support optical assemblies from porcelain insulators, such as the Form 72 and 45H7. General Electric has developed a single clamp collar, held by one screw, which fits over the lower bead of the insulator and top of reflector. This results in quicker installation, stronger joint, and better insulation than previous methods.

SIMPLER MOUNTING FOR LARGE REFLECTORS. Now General Electric engineers offer a new way to mount the large "A" type casings to Form 79 and 101 hoods. An external clamp hooks onto existing lugs on the outside of the hood. You simply hang the casing in place—lock it there by tightening the clamp screws. By eliminating the handling of small parts, assembly is simpler.

GOOD STREET LIGHTING BUILDS GOOD WILL

These are the latest of many developments which General Electric has pioneered to help you provide better street lighting at lower cost. For full information on any item, call our nearest office or write to Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



SELENIUM RECTIFIER for 3-ph bridge connection has the cells mounted vertically, abutting vertical cooling bar and fins made from aluminum alloy. The larger cooling area has brought about an increase in output rating. At right, is a cover with contacts removed

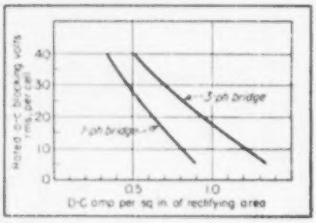
Selenium Rectifier Uses New Cooling Method

A METALLIC RECTIFIER, employing selenium cells, has been developed to utilize a large cooling arrangement which aids in increasing the output rating.

The rectifier cells are mounted vertically and abut with their full surface onto an aluminum alloy cooling bar. Each bar has vertical fins which are perpendicular to the surface of the cells (see illustration). Thus the generated heat can be dissipated almost immediately. The fins can be cooled by convection or placed in an air stream. By the cooling arrangement, the cells can be operated at 10 times stack rating when self-cooled, 20 times the rating when fan or water cooled, and up to 50 times normal for a short-time overload. Cell temperature is limited to 75 C (167 F). Efficiency for a 3-ph bridge is approximately 75% at 10 times, and approximately 70% at 20 times the usual rating when self-cooled.

The rectifier cells are easily replaced by removal from their individual studs. In some units only one-tenth the usual number of plates need be used, thus reducing the overall dimensions. The construction of the unit permits the cells to be hermetically sealed in an aluminum container from which only the fins will be projecting.

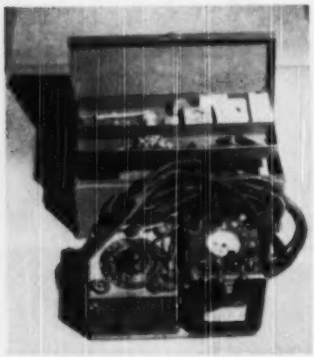
A cell processing method has been developed whereby the blocking voltage can be raised to 40 v rms a-c per cell, and the forward resistance kept down to a minimum dependent upon the blocking voltage. The design permits the d-c watts output to be approximately doubled. Relation between rated a-c blocking volts and current density of effective rectifying area is shown in the graph for condition of natural air cooling. For fan-cooled ratings multiply current density ratings by factor 2 to 2.5, depending upon operating conditions. For 3-ph half-wave ratings, multiply 3-ph bridge ratings by 0.9. The cells in over-all sizes range from 1x1 in. to 5½x5½ in., with actual rectifying areas, respectively, 0.75 sq in. to 26 sq in.



RELATION of a-c blocking volts to current density for multi-volt selenium rectifier cells, natural air cooling. See text for details

The Powerectors are manufactured by the Kotron Rectifier Corp, Newark, N. J., an affiliate of Standard Arcturus Corp, under an exclusive license granted by the inventor, J. P. Tugendhat.

•



BY LEAVING OUT excess trimmings and unnecessary equipment, weight of meter testers' equipment has been kept to 40 lb. This includes rotating standard, standard portable phantom load, leads and tool kit

Austerity Cuts Weight Of Meter Testers' Kit

BY keeping to a bare minimum equipment carried by a meter tester, Washington Water Power Co has provided meter testing equipment which weighs only 40 lb.

A rotating standard such as a GE-type 1B-10 and a standard portable phantom load rated 0-50 amp, 120/240 v are mounted on a ¾-in. oak board. A leather strap overall serves as a carrying handle. Leads are left attached to the equipment and strapped to the leather handle for carrying.

Tools and other auxiliary equipment are carried in a small metal tool box. Weight of the tool kit is 16 lb, and of the standard and phantom load 24 lb, making the 40-lb total. Carried one in each hand they make a balanced load which can be carried with a minimum of fatigue.

MUCH ELECTRICAL MANUFACTURING MAGIC BEGINS HERE

● One of the best known manufacturers of air circuit breakers in the country is the I-T-E Circuit Breaker Company, located at 19th and Hamilton Streets in Philadelphia. From its inception the company has displayed unusual receptiveness to new ideas, whether from within or without; hence it has done its share of pioneering, and perhaps more. Revere is proud to play a part in its progress, through close collaboration with I-T-E engineers, production men, and the purchasing department. The extensive use of Revere Extruded Shapes is but one result of our mutual attack upon I-T-E problems, which the company is good enough to say has saved a great deal of money, as well as made possible a better product... Perhaps similar results would be obtained if you gave us the opportunity to place our knowledge as well as our metals at your disposal. Why not inquire?

REVERE

COPPER AND BRASS INCORPORATED

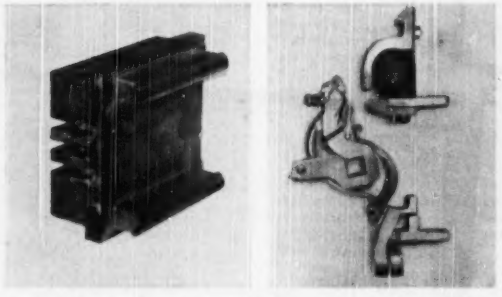
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

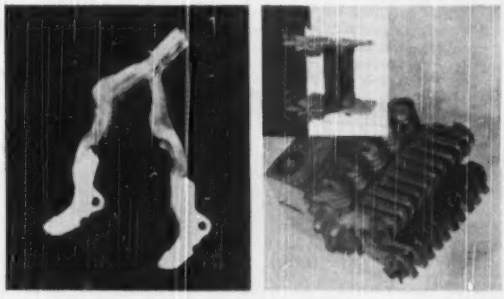
• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

This is but a part of the I-T-E Stock of Revere Extruded Shapes in copper, brass, manganese bronze, and aluminum. I-T-E is a great advocate of extruded shapes, from long experience finding them markedly superior in uniformity, strength, and economy due to the fact that a great deal of machining is avoided.



(*Left*) I-T-E Contact Block made from an extruded shape. This was formerly extruded in electrolytic copper; changing to Revere Free-Cutting Copper resulted in a saving of 30% in machining time. (*Right*) I-T-E "K" Breaker, Main Contact Assembly in open position. This is an especially interesting assembly, since it shows no less than eight extruded shapes in copper and bronze. Use of these shapes makes the assembly more compact, stronger, lighter, and considerably more economical to produce. The contacts are silver alloy, and the unit is silver plated.... In addition to supplying I-T-E with extruded shapes, and strip, Revere furnishes rolls, bar, rod, sheets, in a wide range of non-ferrous alloys, and seamless brass tube.



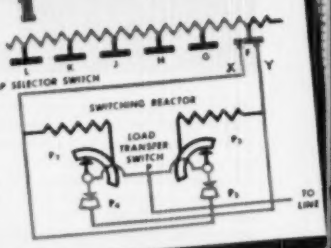
(*Left*) Main movable Contacts and Flexible Connectors in an I-T-E "K" Type Circuit Breaker. The two contacts are made from Revere Extruded Shapes. Revere and I-T-E collaborated closely on the specifications for the thin-gauge copper strip for the pigtails, working out the correct gauge and temper to avoid notch effects and cracking of the connection at the braze. (*Right*) Main Separable Contacts from an I-T-E Type "LG" Circuit Breaker. These are stamped from Revere Copper Strip with the temper specially controlled to eliminate a de-burring operation previously found necessary to obtain edge surface suitable for electrical contacts. (*Inset*) Back view of "K" type Breaker showing a similar type of contact.

NEW PRINCIPLE OF REACTOR SWITCHING FEATURED ON MOLONEY

SCHEMATIC DIAGRAMS showing sequence of switching operations and how Switching Reactor loss is eliminated in all operating positions on 1¼% step voltage regulating apparatus and in half of the positions on ⅝% step voltage regulating apparatus

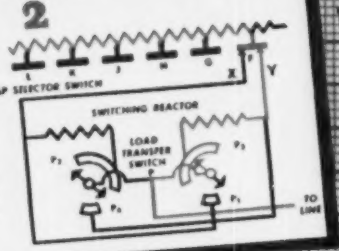
1

Switch positions for Load Tap Changer Operating Position No. 1 on either ⅝% or 1¼% step voltage regulating apparatus (assuming Reversing Switch is in Buck position). A 10% voltage buck is provided in this position. Note that reactor is by-passed.



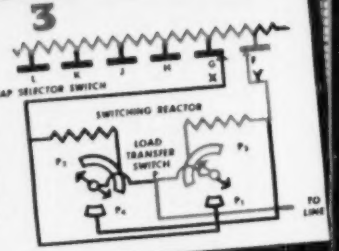
2

Assuming there has been an increase in load and the line voltage decreases, the Automatic Control, after a time delay, actuates the driving motor. The motor drive mechanism rotates the Load Transfer Switch 45° counter-clockwise, shunting all of the current through one half of the Switching Reactor.



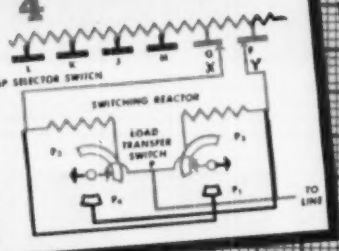
3

While the Load Transfer Switch remains in the position shown in Fig. 2, the motor drive mechanism continues to operate and rotates the Tap Selector Switch to the bridging position illustrated above. No arcing takes place since no current is flowing through moving contact X.



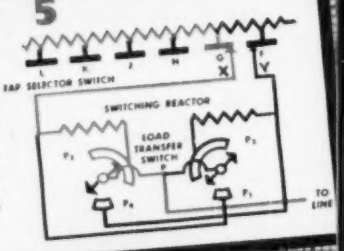
4

Load Transfer Switch rotates 45° counter-clockwise and Load Tap Changer is then on bridging position (Operating Position No. 2), raising the output voltage ⅛%. Current now flows through both halves of reactor. Tap change has been completed on ⅛% step apparatus. On 1¼% step apparatus this is a transitory position.



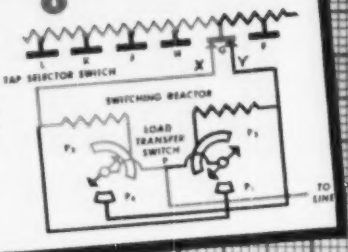
5

On 1¼% step apparatus the motor drive continues to operate and rotates the Load Transfer Switch 45° counter-clockwise, again shunting all of the current through one half of the reactor in preparation for the movement of the Tap Selector Switch to its next position.



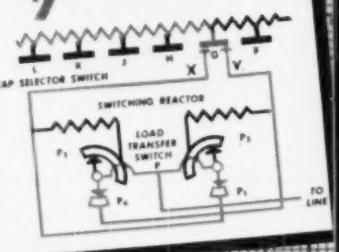
6

With no current flowing through moving contactor Y, the Tap Selector Switch now moves to the next position with X and Y on stationary contact G.



7

Next, the Load Transfer Switch rotates 45° counter-clockwise to complete the tap change. There is no reactor loss since the current flows through parallel by-passing circuits X, P1, P and Y, P4, P to the line. Load Tap Changer is now in Operating Position No. 2 on 1¼% step apparatus.



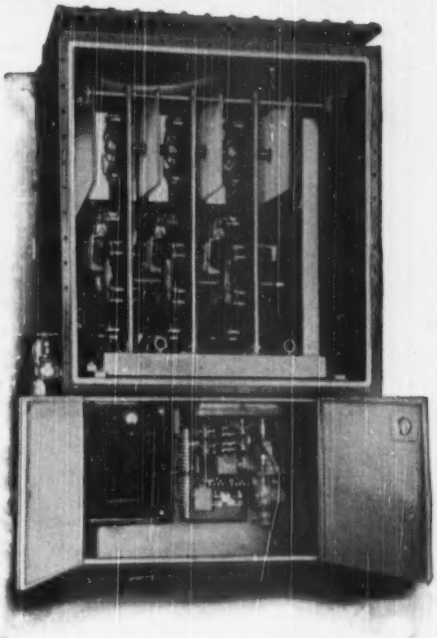
Another Superior **MOLONEY** *Product*

LOAD TAP CHANGERS

"M" SERIES LOAD TAP CHANGERS USED ON MOLONEY STEP VOLTAGE REGULATORS, POWER REGULATING TRANSFORMERS AND LOAD RATIO CONTROL TRANSFORMERS INCORPORATE REACTOR BY-PASS SWITCHING

SWITCHING REACTOR LOSSES ARE *ENTIRELY ELIMINATED* ON VOLTAGE REGULATING APPARATUS WHEN REGULATION IN 1¼% STEPS IS USED

Moloney "M" Series Load Tap Changers are provided on Load Ratio Control Transformers, Power Regulating Transformers, and medium and large ratings of Step Voltage Regulators. A separate switch is used for breaking load current, a feature heretofore supplied on only the very large ratings of regulating apparatus. The design of this switch and the timing of its operation in conjunction with the Tap Selector Switch, are such that the Switching Reactor is by-passed in *all* operating positions on 1¼% step apparatus and in *half* of the positions on ⅝% step apparatus. Since no current flows through the reactor when it is by-passed, there are no reactor losses. How by-passing is accomplished and the sequence of operations in changing from one tap position to another, is illustrated on the opposite page.



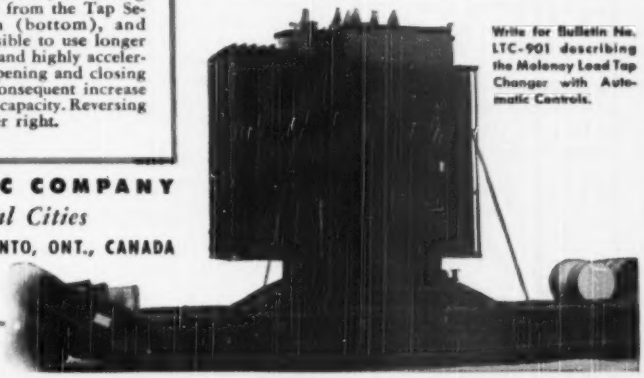
Moloney three-phase Load Tap Changer with automatic controls. Top assembly contains Tap Selector Switch, Load Transfer Switches and Reversing Switch. Motor drive and auxiliary equipment are at lower right. Automatic controls are at lower left. Moloney Automatic Control equipment features a supersensitive voltage regulating relay and an electronic time delay circuit. A complete line of remote-manual and automatic controls and associated equipment is available.

The Tap Selector Switch on Moloney Load Tap Changers does not have to perform the dual function of breaking current and changing taps. A separate Load Transfer Switch (upper left) makes and breaks the circuit, eliminating all arcing duty from the Tap Selector Switch (bottom), and making it possible to use longer arc clearances and highly accelerated breaker opening and closing speeds, with consequent increase in interrupting capacity. Reversing Switch at upper right.

MOLONEY ELECTRIC COMPANY

Sales Offices in all Principal Cities

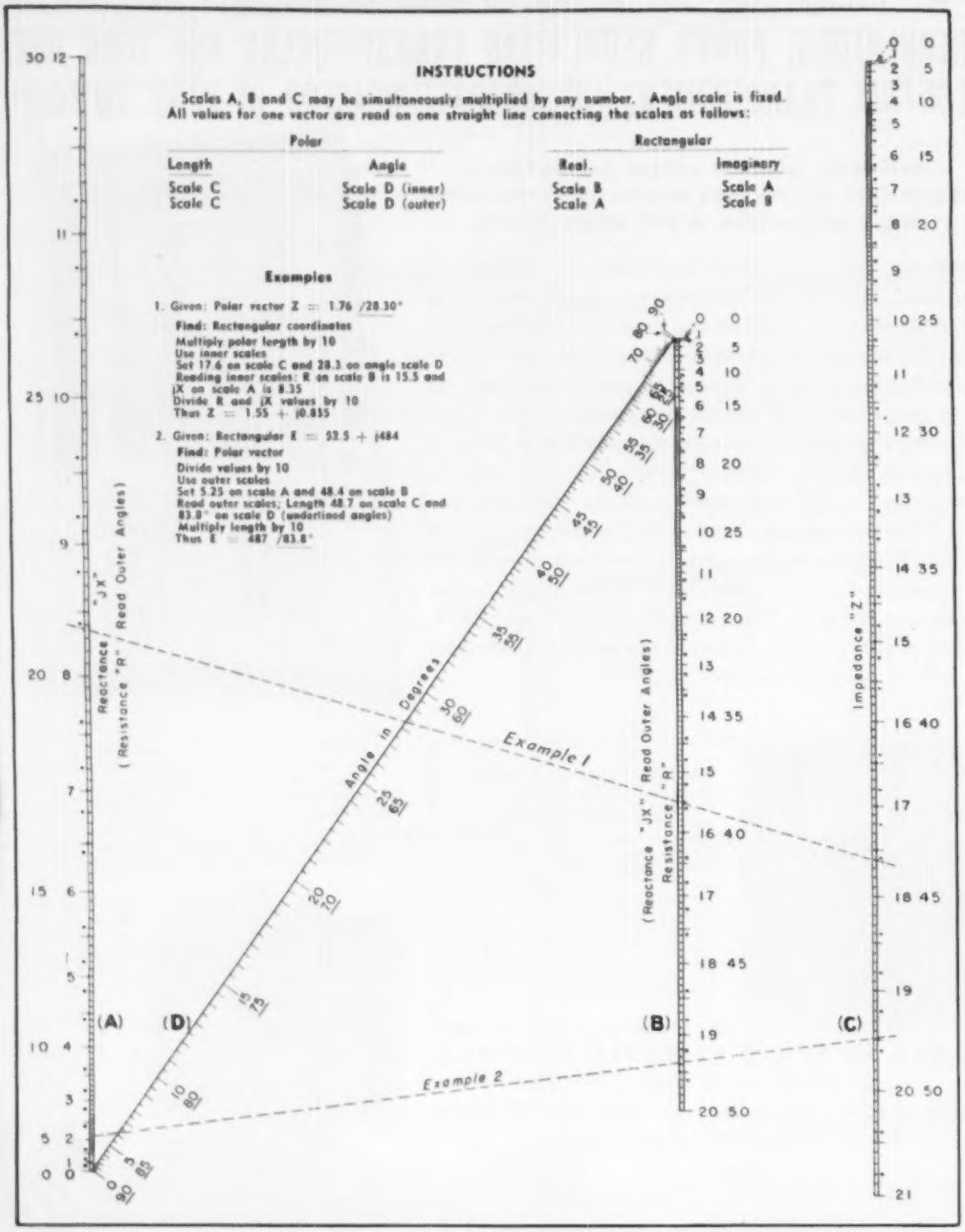
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA



Write for Bulletin No. LTC-901 describing the Moloney Load Tap Changer with Automatic Controls.

Vector Conversion Nomogram—Polar-Rectangular

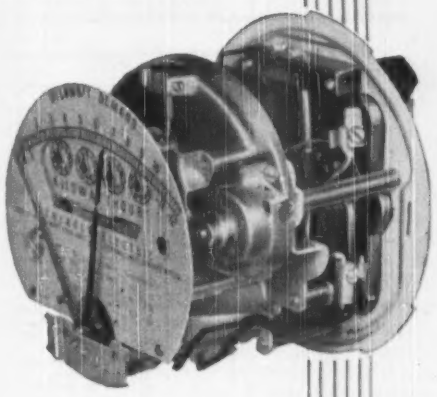
R. W. BAKER, Distribution Engineer, Georgia Power Co, Atlanta, Ga.


INSTRUCTIONS
Scales A, B and C may be simultaneously multiplied by any number. Angle scale is fixed.
All values for one vector are read on one straight line connecting the scales as follows:
Polar
Length
Angle
Rectangular
Real
Imaginary
Scale C
Scale C
Scale D (inner)
Scale D (outer)
Scale B
Scale A
Scale A
Scale B
Examples
1. Given: Polar vector Z = 1.76 /28.30°
Find: Rectangular coordinates
Multiply polar length by 10
Use inner scales
Set 17.6 on scale C and 28.3 on angle scale D
Reading inner scales: R on scale B is 15.5 and jX on scale A is 8.35
Divide R and jX values by 10
Thus Z = 1.55 + j0.835
2. Given: Rectangular E = 52.5 + j484
Find: Polar vector
Divide values by 10
Use outer scales
Set 5.25 on scale A and 48.4 on scale B
Read outer scales; Length 48.7 on scale C and 83.8° on scale D (undertined angles)
Multiply length by 10
Thus E = 487 /83.8°
Reactance "jX"
(Resistance "R" Read Outer Angles)
Angle in Degrees
(Reactance "jX" Read Outer Angles)
Resistance "R"
Impedance "Z"
Example 1
Example 2
(A)
(D)
(B)
(C)

ECONOMICAL, ACCURATE MEASUREMENT OF SMALL DEMANDS

thermally..

G-E WATTHOUR THERMAL DEMAND METER, TYPE IHM



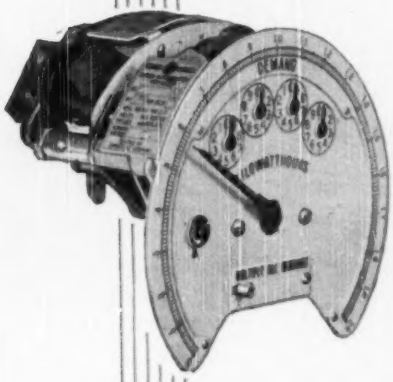
Reliability and lower maintenance costs are assured with this meter because the thermal element operates on the "direct-heat" principle. This produces a greater torque which permits the use of larger, sturdier parts. The direct-heat element also eliminates heat transfer. As a result, the meter will not overshoot on transient loads, response time can be easily predicted, and shorter testing time is possible.

Sustained accuracy at high and low loads is assured by the wide-limit watthour-meter element. It also has braking magnets die-cast in the frame for added stability, and a relief gap that provides a controlled breakdown point.

This meter will save you installation costs because, though it is essentially two meters in one case, it fits standard watthour-meter installations. Complete details are available in Bulletin GEC-408.

mechanically..

G-E INDICATING DEMAND REGISTER, TYPE M-30



Your maintenance costs will be low with this register. A novel application of the Geneva mechanism resets the pointer-pusher by direct-drive gearing, thereby eliminating the need for the spring and latch mechanism found in conventional demand registers. Interval resetting is accomplished with precision and freedom from shock.

Liberal spacing of plates, shafts, and gears gives maximum visibility for inspection. Very substantial plates, plus parallel arrangement of shafts, insure perfect alignment of parts and stability of bearings with minimum adjustments. And, the fewer number of parts assures lower maintenance costs.

This register is available to replace the standard kilowatthour registers on a large variety of a-c watthour meters. Your nearest G-E representative will be glad to discuss your particular application, and fill your order. Call him today.

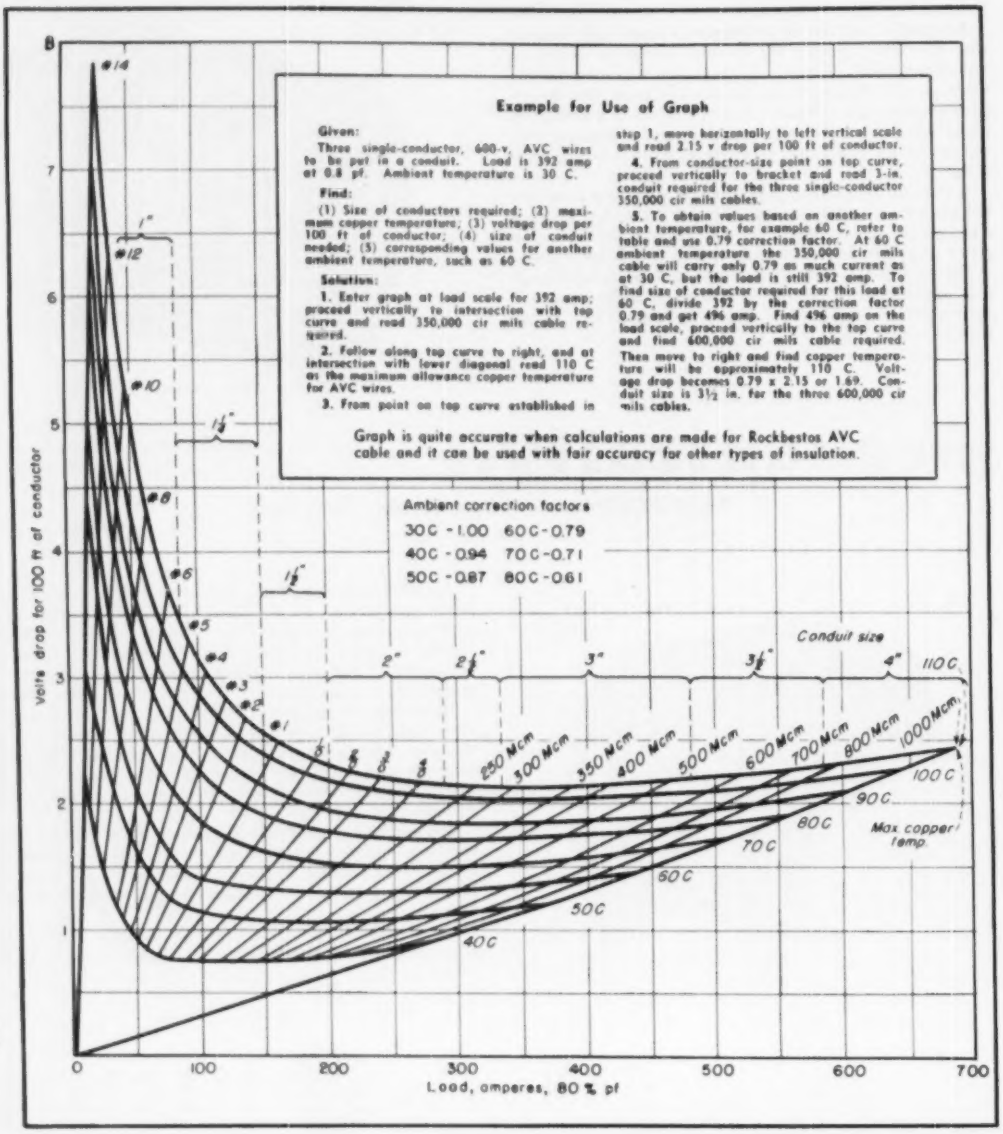
More details are available in Bulletin GEC-413. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

Determine Voltage Drop and Conduit Size For Three Single-Conductor, 600-v Cables

H. S. MOORE, Chief Engineer, Rockbestos Products Corp, New Haven, Conn.

Graph gives voltage drop and copper temperature when cables carry rated and less than rated current, also size of conduit, based on 30 C ambient temperature. Top curve shows the rated current (at maximum copper temperature) for the sizes of wire shown, when three wires are installed in a single conduit load is on basis of 0.8 power factor.


Example for Use of Graph
Given:
Three single-conductor, 600-v, AVC wires to be put in a conduit. Load is 392 amp at 0.8 pf. Ambient temperature is 30 C.
Find:
(1) Size of conductors required; (2) maximum copper temperature; (3) voltage drop per 100 ft of conductor; (4) size of conduit needed; (5) corresponding values for another ambient temperature, such as 60 C.
Solution:
1. Enter graph at load scale for 392 amp; proceed vertically to intersection with top curve and read 350,000 cir mils cable required.
2. Follow along top curve to right, and at intersection with lower diagonal read 110 C as the maximum allowance copper temperature for AVC wires.
3. From point on top curve established in step 1, move horizontally to left vertical scale and read 2.15 v drop per 100 ft of conductor.
4. From conductor-size point on top curve, proceed vertically to bracket and read 3-in. conduit required for the three single-conductor 350,000 cir mils cables.
5. To obtain values based on another ambient temperature, for example 60 C, refer to table and use 0.79 correction factor. At 60 C ambient temperature the 350,000 cir mils cable will carry only 0.79 as much current as at 30 C, but the load is still 392 amp. To find size of conductor required for this load at 60 C, divide 392 by the correction factor 0.79 and get 496 amp. Find 496 amp on the load scale, proceed vertically to the top curve and find 600,000 cir mils cable required. Then move to right and find copper temperature will be approximately 110 C. Voltage drop becomes 0.79 x 2.15 or 1.69. Conduit size is 3½ in. for the three 600,000 cir mils cables.
Graph is quite accurate when calculations are made for Rockbestos AVC cable and it can be used with fair accuracy for other types of insulation.
Ambient correction factors
30C - 1.00 60C - 0.79
40C - 0.94 70C - 0.71
50C - 0.87 80C - 0.61
Volts drop for 100 ft of conductor
Load, amperes, 80 % pf
Conduit size
#14
#12
#10
#8
#6
#5
#4
#3
#2
#1
1/0
2/0
3/0
4/0
250 Mcm
300 Mcm
350 Mcm
400 Mcm
500 Mcm
600 Mcm
700 Mcm
800 Mcm
1000 Mcm
110C
100C
90C
80C
70C
60C
50C
40C
Max copper temp.

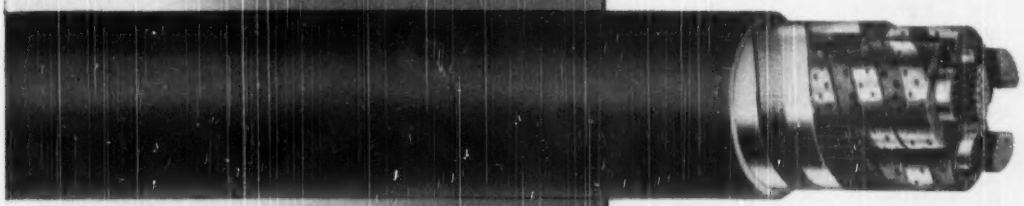
Today it's Roebling!

Unsurpassed service at lowest cost with Roebling Paper Insulated Cable

YOU NEVER WANTED ECONOMY MORE than you do today . . . and you'll get it by putting circuits underground with Roebling Paper Insulated Lead Encased Cables! No more unsightly overhead lines with their expensive upkeep . . . trouble-free service, uninterrupted and dependable, is yours for years on end.

Roebling Shielded Type H is outstanding for 3-phase grounded neutral circuits from 13 to 33kv. It is available in single and multiple conductor construction, in regular and Compack strand (round or sector). Conductors are shielded with metallized paper, individually insulated, protected with perforated copper shielding tape, and the whole assembly served with a bronze binder tape and lead sheathed. Similar assemblies can be made to your special specifications.

Your nearest Roebling office and sales engineer will be glad to help you select the *right* cable for top performance and economy. John A. Roebling's Sons Company, Trenton 2, New Jersey.



There's a Roebling electrical wire or cable for practically every transmission, distribution and service requirement. All of them are made completely in Roebling plants where the most modern techniques and precision machines assure products of the very highest quality.

ROEBLING

A CENTURY OF CONFIDENCE

Atlanta, 934 Avon Ave. ★ *Boston*, 31 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Avenue S.

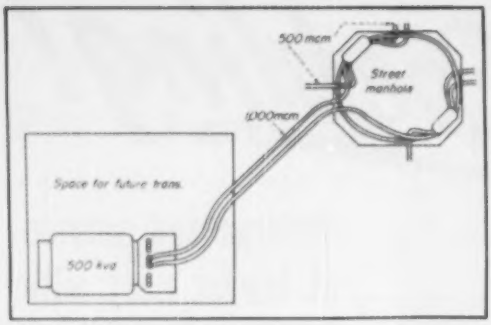


FIG 1—FORMER CONSTRUCTION had each circuit of the a-c mains spliced to 1,000 Mcm ties to network transformer in street manhole. Big difficulty was making a satisfactory splicing arrangement in manhole with up to ten 1,000 and 500 Mcm cables per phase

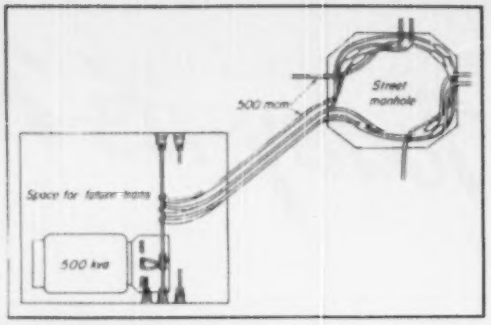


FIG 2—IMPROVED ARRANGEMENT has each circuit of a-c mains tied to vault bus. Transformer is tied to bus by 2-1,000 Mcm non-leaded cables thus eliminating large splice joints and 1,000 Mcm ties to street manhole. Other mains need not be disturbed during fault

Vault Bus Simplifies Connections to A-C Mains

J. P. LOZES, JR.
Asst Opr Engineer
Electric Distribution Department
New Orleans Public Service, Inc.

SEVERAL years ago the standard construction of ties between transformers and mains on the underground a-c network system of New Orleans Public Service, Inc, was changed. The older construction embodied two 1,000 Mcm cables per phase from each 500-kva, 3-ph network transformer, these cables terminating in a special Y-connector at the network protector studs, and in extremely large joints in the street manhole (see Fig 1). It had long been realized that this type of construction had two very bad features: (1) Difficulty in clearing any fault that might occur on the 1,000 Mcm cable and (2) the difficulty in making up a satisfactory splice or splicing arrangement in the manhole splicing together the two 1,000 Mcm cables from the transformer, and four to eight 500 Mcm cables of the mains, per phase. This system was even worse when there were two 500-kva transformers in the one vault.

New Construction

The newer construction utilizes an open copper bar bus in the transformer vault. Each circuit of a-c mains is brought directly to this bus with only a "single" joint in the intersection manhole. The transformer is tied to this bus by 2-1,000 Mcm non-leaded cables. Thus the large joints are eliminated, and the 1,000 Mcm ties are likewise eliminated (see Fig 2).

Other advantages are also evident. An additional transformer may be placed in the vault with no rearranging of secondary cables, the two cables from each phase of the network protector merely being tied to the bus. Also additional circuits of mains may be added without rearranging. In case of fault, the circuit of 500 Mcm mains in trouble may be quickly isolated without disturbing any additional mains.

In New Orleans, the a-c mains operate half the time under water, and rubber insulated, lead-covered cable is used exclusively. The method described here is the only one that has been found that will give a watertight job and yet make a neat arrangement with the advantages mentioned above. Occasionally, the copper bar bus has been submerged, but as long as the ends of the cables going to the bus are well sealed, no damage has ever occurred.

• • •

Meter Mounting Device For 200-Amp Service

TO UTILIZE the 300% and 400% load characteristics of modern 15- and 50-amp meters, Duncan Electric Mfg Co has developed a 200-amp meter mounting device. The increased capacity of this device, designated type HD, recognizes the increasing use of higher capacity service. Moreover, extending the use of self-contained meters from 100- to 200-amp thus eliminates the need for current transformers in approximately 80% of present installations and affords an opportunity for economy in metering.

Self-contained socket type meters can therefore be used on services up to 200-amp capacity. Provision is made for connecting the heavy line conductors (up to 4/0 copper or 250,000 cir mils aluminum) directly to the terminals of the current coil. The type HD device has been designed for continuous load service.

Pressure connectors for the line conductors and vise-jaw terminals for the meter blades are cast as a heavy bronze unit. Positive contact pressure

YOU CAN SPECIFY SIZE
YOU CAN SPECIFY SHAPE
YOU CAN SPECIFY ELECTRICAL TESTS
BUT YOU *can't specify*
WHAT YOU REALLY WANT
Performance!

After passing all the elaborate standard tests, one big question still remains to be asked of a station insulator--"How long will it continue to meet these specifications?"

Among reputably-made insulators, little difference exists when they are new. You get about the same from any manufacturer. But it's not so much *what you get* as *what you keep!*

With thousands of O-B station insulators now in their "forties" and still meeting original specifications, we know of no better proof that you *keep* more when you buy O-B.

Ohio Brass

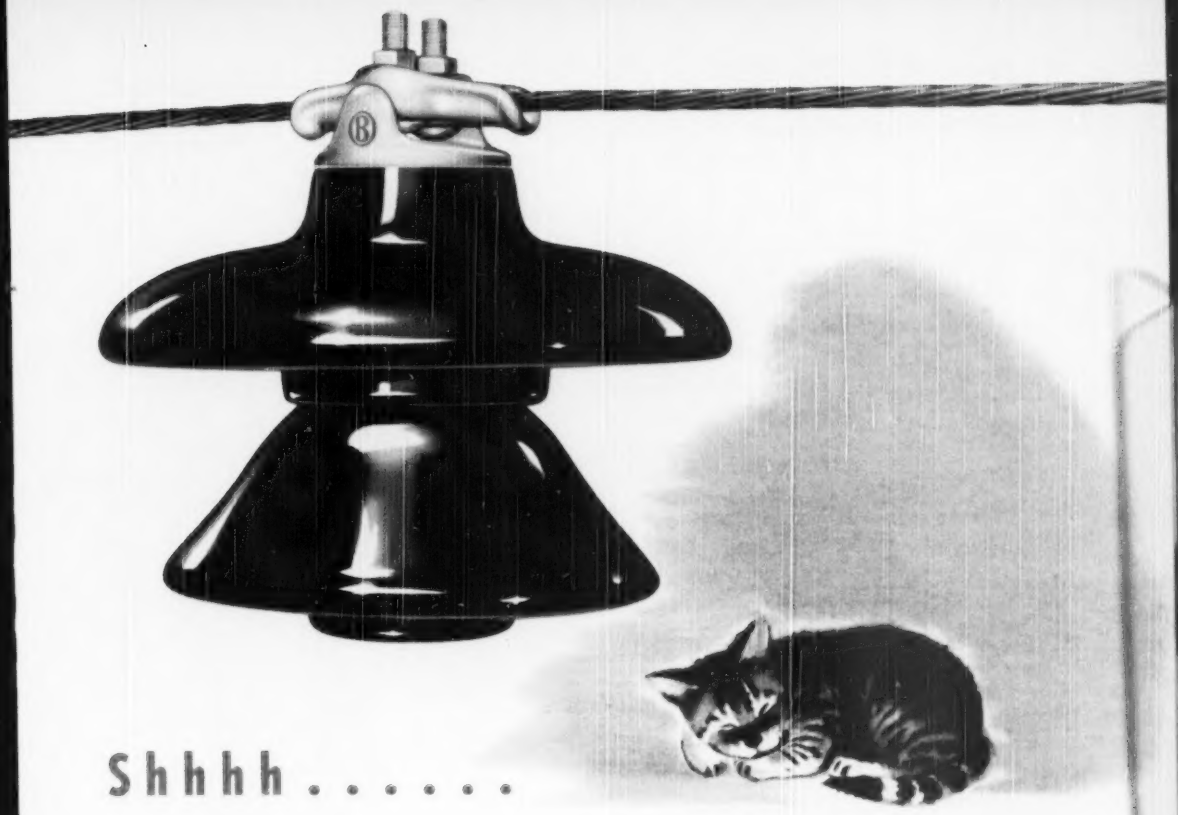
MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

A Spotless 25 Year O-B Record Guided this *Choice of Insulators*

Twenty-five years ago, this power company started using O-B suspension insulators. This original line has operated without a single case in its entire life where an interruption has been credited to the deterioration or inherent weakness of its insulation. Other O-B-insulated lines have been built since, with comparable performance records.

Naturally, on this company's new and most important 132-kv line, O-B suspension insulators were specified. This obviously sound CHOICE OF INSULATORS is *your* best guide to high operating performance and low maintenance.



Shhhh.....

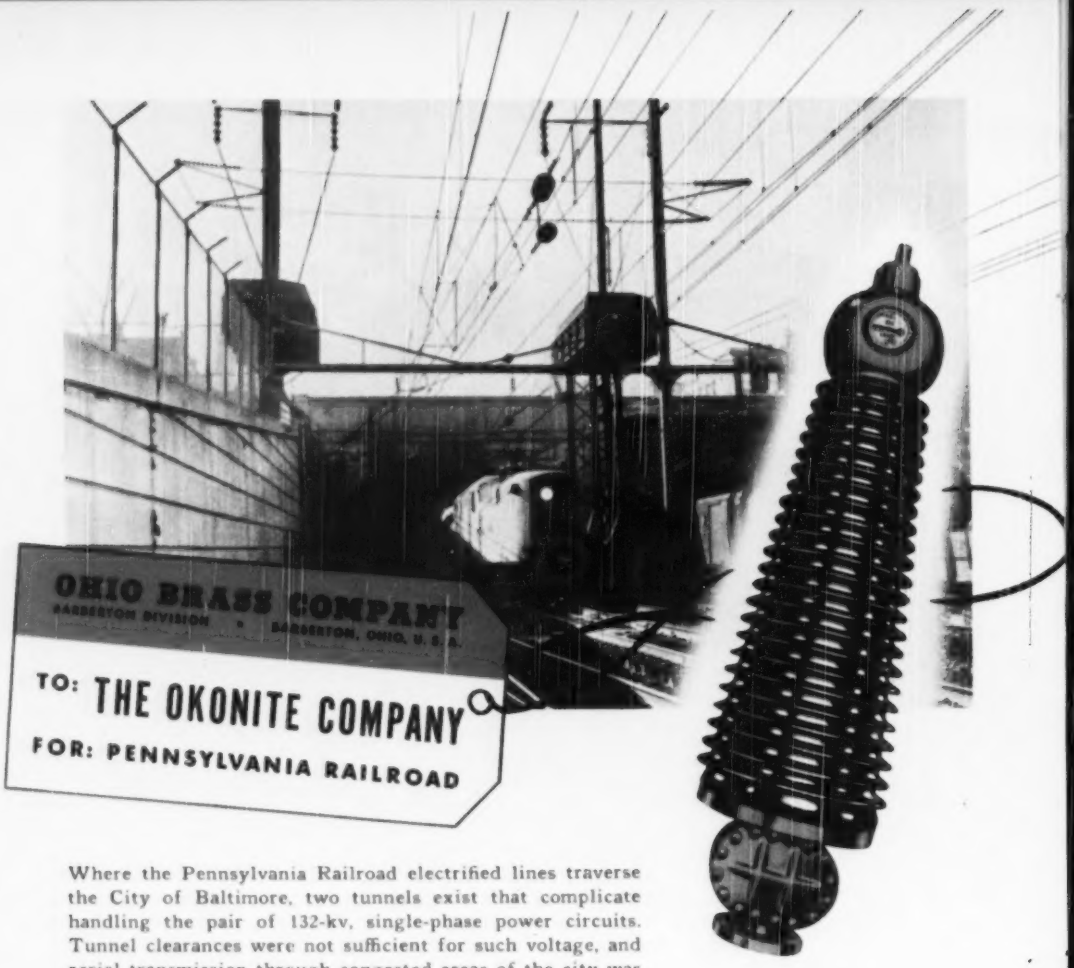
While line crews praise the attachment feature of O-B Clamptop insulators that makes them fast and safe to work hot, and while the operating men like them for their reduction in line maintenance, there's still another vote cast by Management. No other pintype insulator of any kind, size, or shape is as radio-quiet as a Clamptop. Tie wire noises are eliminated--there is no tie. Conductor attachment stays tight. The highly-charged head casting that forms the clamp base is set into the porcelain, thus greatly improving the electrostatic field of the insulator and silencing another potential source of radio interference. O-B semi-conductive Silentype glaze completes the picture.

For sub-transmission and high voltage distribution through populated districts, O-B Clamptops will help keep your public relations satisfactory--at the same time giving you the finest kind of insulator performance.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*



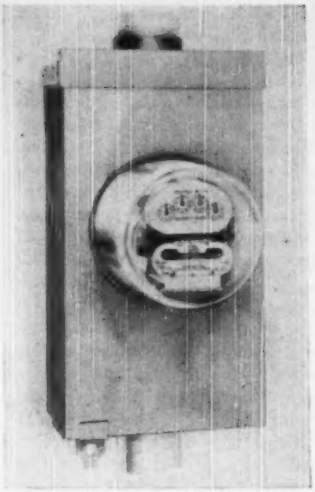
Where the Pennsylvania Railroad electrified lines traverse the City of Baltimore, two tunnels exist that complicate handling the pair of 132-kv, single-phase power circuits. Tunnel clearances were not sufficient for such voltage, and aerial transmission through congested areas of the city was impossible. To meet this problem, the first commercial installation of Oilostatic cable was made in 1935. Two, seven-inch pipes, 17,000 feet long, contain two conductors each under a constant 200-pound static oil pressure. Other facts regarding this installation are, according to the Okonite Company . . . "Conductor size, 500,000 cir mils. Rated current, 500 amperes. Load factor, 100 per cent. Copper temperature, 70 C. Operated for 15 trouble-free years with . . ."

O-B POTHEADS AN ESSENTIAL PART OF OILOSTATIC CABLE

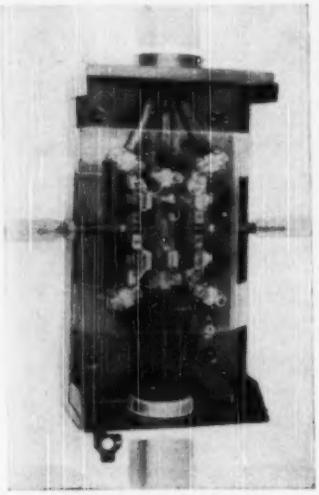
Ohio Brass

MANSFIELD, OHIO, U. S. A.

3036-H



BY-PASS CLAMPS can be attached to the line and load terminals for the meter blades, and meter removed or tested without interrupting load service. Overall dimensions—18 in. high, 9 in. wide and 4¾ in. deep



METER MOUNTING DEVICE for use on services to 200-amp capacity—single phase, 3-w network, or 3-ph, 3-w service. Weatherproof box and Neoprene gasket seals around meter cover make housing suitable for indoor or outdoor mounting.

for all electric connections is insured by pressure connections to the meter blades and the conductors. The bronze castings are mounted to an arc-resistant Rosite block. A standard test jack may be used in the device for testing meters in the conventional manner.

Any capacity of self-contained sin-

BERMICO* FIBRE CONDUIT

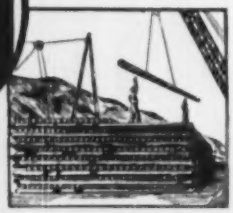
BERMICO CONDUIT IS REALLY RUGGED—IT'S BUILT TO TAKE ROUGH HANDLING ON THE JOB.
ITS CLEAN, SMOOTH BORE MAKES PULLING CABLES THROUGH BERMICO FIBRE CONDUIT QUICK AND EASY.

distributed by
WESTINGHOUSE ELECTRIC SUPPLY COMPANY
Offices in all leading cities

BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

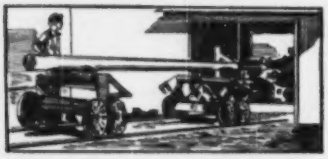
LONG-LIFE DOUGLAS FIR PRESSURE TREATED LONG POLES

For over 50 years J. H. Baxter & Co. with its Associated Pacific Coast Companies has specialized in the production and sale of exceptionally long (up to 125 feet) Wood Poles for the electric power, lighting and telephone utilities . . . Stocks in all lengths are complete — shipments prompt!



PROPER SEASONING

BAXCO poles are carefully seasoned in dry, clean yards. Proper pre-conditioning before Pressure Treatment adds years of longer life.

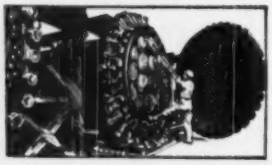


MACHINE SHAVING

To produce smoother and more uniform poles, the BAXCO process includes machine shaving. This removes small swells and results in a more round, evenly tapered product.

PRESSURE TREATMENT

Deep penetration and high retention of the preservative is a hallmark of the BAXCO Pressure Treatment Method.



Get the Full Story! Write today for this BAXCO BOOKLET

J. H. Baxter & Co.

321 MONTGOMERY STREET · SAN FRANCISCO 4, CALIFORNIA

ASSOCIATED COMPANY: J. H. BAXTER & CO., OF OREGON

gle-phase or 2-element network meter of standard dimensions may be used in the type HD device. On many services with line conductors even up to 200-amp capacity, the diversity is such that the demand does not exceed 60 amp and the standard 15-amp meter may be used. On most services of 200-amp capacity the demand will not exceed 150 amp and the standard 50-amp meter may be used. For those cases where the demand approaches the 200-amp capacity of the line conductors, Duncan will supply a 50-amp, 3-w, 1-ph extended load range meter—the MF-SE (see illustration), and a corresponding combination watthour and thermal demand meter —type TF-SE (48-kw demand). When used in the type HD device with conductors of corresponding size, the type MF-SE or TF-SE meters are suitable for loads up to 200 amp continuously. Additional copper has been added and the overload characteristics are such as to give commercial accuracies to 400% load. These meters have the same test constants and dimensions as the corresponding MF-S and TF-S meters and may be used in any standard socket to the thermal limits of the installation.

•

FLASHLIGHT easily converted into test lamp

Plastic Flashlight Case Makes Good Test Lamp

A. R. CONSTANT
Narragansett Electric Co
Providence, R. I.

A FLASHLIGHT with a plastic case can serve as a test lamp, with slight modification. As shown in the sketch, two holes are drilled in the case. One goes through the center of the end piece; the other on the slanted part of the head piece. Each accommodates a 6/32-in. screw ½ in. long. A light flexible wire 3 in. long is soldered to the washer side of the head of each screw. Screws are held firmly in place by nuts. The wire going to the battery negative

OPERATION '50

ROLLER SMITH

ELPEC

"Operation '50" will consolidate these two famous names under one roof in Bethlehem, Pennsylvania.

Now underway is a large new plant where unsurpassed engineering talent plus expanded production facilities will continue to provide you with products long known for their quality and superior performance in the Electric Utility, Industrial and allied fields where precise measurement, reliable switching and safe control are of paramount importance.

LOW VOLTAGE AIR CIRCUIT BREAKERS • POWER CIRCUIT BREAKERS • POWER SWITCHING EQUIPMENT • BUS SUPPORTS AND FITTINGS • LOW VOLTAGE DRAWOUT TYPE SWITCHGEAR • METAL CLAD SWITCHGEAR • GENERATOR LEADS AND STATION BUS RUNS • OUTDOOR SUB STATIONS • UNIT SUB STATIONS • INSTRUMENTS • WATTHOUR METERS • RELAYS • ROTARY SWITCHES • PRECISION BALANCES

ROLLER SMITH
Established 1908

BETHLEHEM, PENNSYLVANIA

ELPEC
Established 1910

ANOTHER VICTOR INSULATOR THAT SAVES AS IT SERVES
Left: Installing Victor suspension insulators on a power line in the Southwest

Install Victor Suspension Insulators

FOR DEPENDABLE ON-THE-JOB PERFORMANCE

No. 800
Clevis type

No. 900
Ball and socket type

VICTOR No.		800 and 900
60 cycle dry flashover	KV	80
60 cycle wet flashover	KV	50
Pos. impulse flashover	KV	125
Neg. impulse flashover	KV	130
Dry arcing distance	In.	7¾
Leakage distance	In.	11½
Impact rating	In. Lbs.	55
M and E strength	Lbs.	15000

CONTINUOUS, trouble-free insulator service *counts* when it comes to *lower* maintenance and replacement costs on transmission lines. That's why more and more successful power companies are *specifying* Victor suspension insulators.

Even under the most severe service conditions, you can rely on Victor's rugged suspension insulators for years of uninterrupted transmission. *Each* one is rigidly inspected and tested at *every* point of manufacture, and must *easily* meet *all* NEMA standards. For you this means dependable performance *on the job!*

Get All the Facts! **CALL YOUR VICTOR REPRESENTATIVE**

J. A. Perkins Co., *Boston, Mass.* • T. B. Dally, *Jersey City, N. J.* • L. Morris Landers Co., *Atlanta, Ga., Charlotte, N. C.* • Continental Sales & Engineering Co., *Pittsburgh, Pa.* • H. J. Schwarberg, *Cincinnati, O.* • David D. Schneider, *Louisville, Ky.* • Brainted & Bair, *Detroit, Mich.* Homer G. Hall, *Princeton, Ind.* • Gaide & Dunlap, *Chicago, Ill.* • E. B. Rouzer Co., *Minneapolis, Minn.* • Fred B. Hearn, *St. Louis (Affton), Mo.* • Chas. L. Ward Co., *Kansas City, Mo.* • Southwest Sales & Service Co., *Shreveport, La.* • George E. Tarbox, *Denver, Colo.* • Myron Swendson, *Boise, Ida.* • Maydwell & Hartzell, *San Francisco, Cal., Los Angeles, Cal., Portland, Ore., Seattle, Wash.*

Also distributed nationally by Line Material Company

VICTOR
INSULATORS Inc.
VICTOR, NEW YORK

Look for this trade mark of enduring service

V

may be soldered either to the spring which makes contact with the battery, or to the metallic threaded part. The wire going to the battery positive may be soldered to the dull side of the reflector, or, if preferred, it can be soldered to the threaded metallic part which holds the bulb.

A second nut on each screw allows forked terminal jumpers to be rigidly held while test probing is done with the other ends of the leads. When test is completed the leads are taken off, reconverting the flashlight, and preventing interference to normal use.

•

Photo-Copying Saves 50%

F. M. CLARK
Supervisor
Office Service Dept
The Dayton Power and Light Co

DURING the one year (approx) that photo-copying equipment has been in operation, the company has realized savings of over 50% in the job of producing papers, documents, maps, etc, by handling its own photo-copying work. Also, the copies are produced in less time, thereby rendering prompt service to the various departments using these facilities.

There is a further saving in labor costs, as one photo-copyist does the work of numerous typists and stenographers who normally would make copies of material now being photo-copied.

•

Line Coal Chutes With Old Belting—Prolong Life

BY LINING the bottoms of coal and ash chutes with discarded rubber belting the necessity of replacing these bottoms every 60 days has been eliminated by Indianapolis Power & Light Co according to Donald L. Snoke, executive engineer. The first such linings, anchored where the coal enters the chutes and laid over the 20-in. wide bottoms, have been in service for a period of over five months and still seem to be in fair condition.

NEW! C-O-TWO

DRY CHEMICAL TYPE FIRE EXTINGUISHER

EXCLUSIVE DESIGN
assures you of fast, positive fire protection

SELF-CONTAINED UNIT . . . rugged construction . . . no extra gadgets protruding or complicated operating parts . . . one of the most efficient, foolproof, easy-to-use fire extinguishers known . . . two convenient sizes, 20 pound capacity and 30 pound capacity.

C-O-TWO DRY CHEMICAL STAYS FREE FLOWING . . . no syphon tubes or valves within the cylinder to become clogged or inoperative . . . discharge hose and squeeze type discharge nozzle remain empty until the fire extinguisher is actuated. Inverting the fire extinguisher before using provides mechanical breakage by changing the position of the dry chemical in the cylinder. Bumping to actuate the fire extinguisher provides additional mechanical breakage as well as continuous carbon dioxide gas pressured agitation or fluffing of the dry chemical. These combined features plus a skillfully blended free flowing extinguishing agent assure you of a faster, more effective and complete discharge.

APPROVED . . . Underwriters' Laboratories, Inc. rating is B-1, C-1. C-O-TWO Dry Chemical is non-conducting, non-corrosive, non-abrasive, non-freezing and non-toxic . . . highly effective on flammable liquid and electrical fires.

RECHARGEABLE ON-THE-SCENE . . . no special tools needed . . . one piece removable top assembly leaves large unobstructed opening in the top of cylinder for refilling. C-O-TWO Dry Chemical for recharging is available in handy pre-measured moisture proof containers.

Write today for complete free information on this new, quick-acting fire extinguisher . . . no obligation.

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

GENERAL ELECTRIC A BRIGHT NEW

Two new General Electric white fluorescent lamps show full beauty of all colors

Colors take on new life

Colors come to life. Complexions glow with new warmth. Fabrics and decorations take on new charm.

The secret is a revolutionary new phosphor, "D-R", in the inside coating of two new General Electric fluorescent lamps, which transforms the effect of the white light they give. The new lamps—1) DE LUXE *COOL* WHITE and 2) DE LUXE *WARM* WHITE—show colors better than fluorescent ever could before, and at the same time offer a choice of cool atmosphere or warm.

Complexions flattered

Fabrics look their best

Cool effect or warm?

With G.E.'s two new lamps, lighting can be planned to create either a cool or a warm atmosphere.

For cool, crisp atmosphere:
DE LUXE *COOL* WHITE

For warm, friendly, intimate surroundings:
DE LUXE *WARM* WHITE

These two new lamps are the greatest advance in fluorescent since G.E. introduced the first fluorescent lamp in 1938. And they'll give fluorescent lighting sales a big boost. The DE LUXE COOL WHITE and DE LUXE WARM WHITE lamps will be introduced early in 1950 in the 40-watt size, later in other popular sizes of G-E fluorescent lamps.

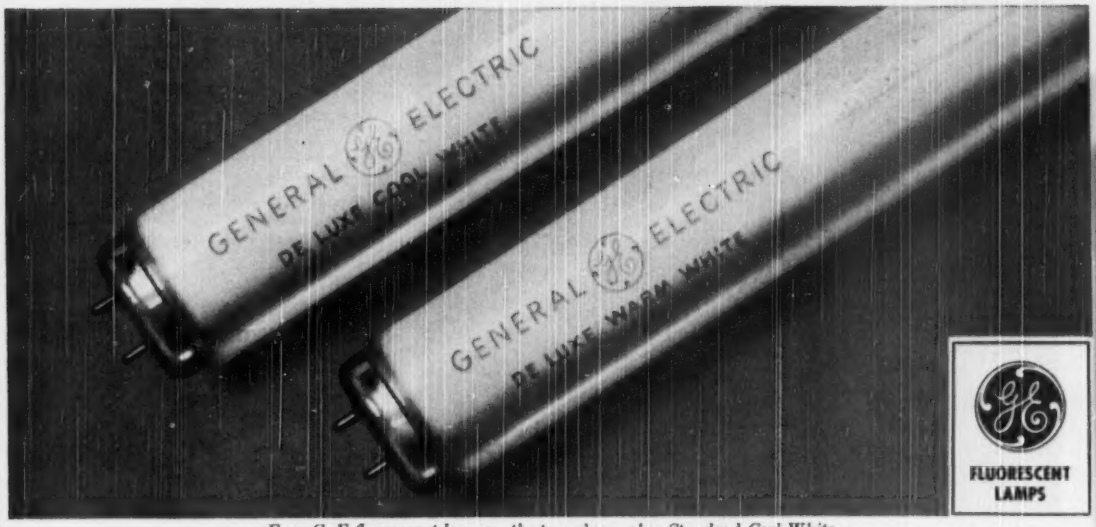
Secret is new "D-R" phosphor

It took years of research to develop the phosphor, "D-R", that made General Electric's new color triumph possible. "D-R" is the first successful "deep red" phosphor ever known.

For business, DE LUXE COOL

For intimacy, DE LUXE WARM

BRINGS YOU WORLD OF COLOR



Four G-E fluorescent lamps—the two above, plus Standard Cool White and Warm White—now meet practically every fluorescent lighting need.

New white lamp line makes selection easy!

The whole question of *which* "white fluorescent lamp" to use is now simplified. The two new lamps—plus two "high-efficiency" lamps—create a line of four G-E white fluorescent lamps that fill practically every fluorescent lighting need.

STANDARD COOL WHITE (formerly 4500)—offers high efficiency with reasonable color rendition. Widely preferred for most working and selling areas.

DE LUXE COOL WHITE—gives best possible color rendition with good (but not highest) efficiency. For cool environment where best color is essential.

STANDARD WARM WHITE (formerly Warm Tint) provides high efficiency combined with color impression of filament lighting.

DE LUXE WARM WHITE combines excellent color rendition with good (but not highest) efficiency. For warm environment where excellent color is essential.

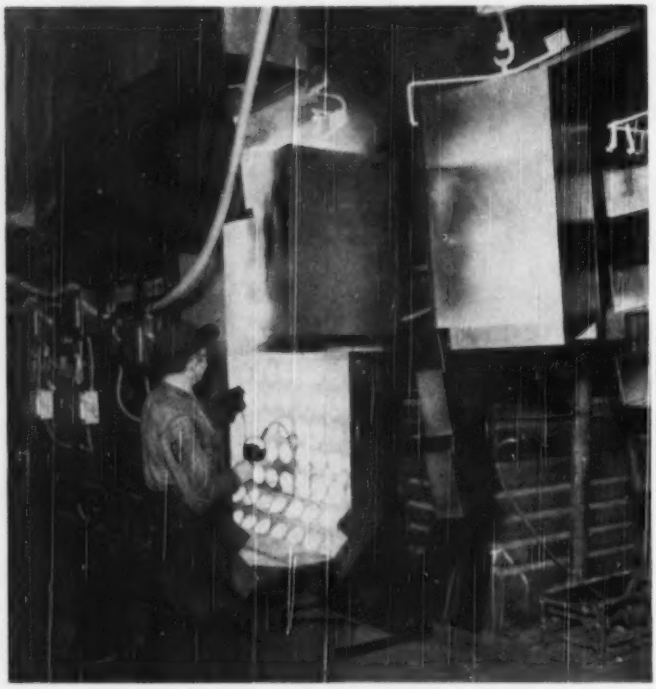
FREE SELECTOR GUIDE

Shows which lamp you need to meet *your* lighting requirements. Write General Electric, Div. 166-E-1, Nela Park, Cleveland 12, Ohio.

You can put your confidence in—

GENERAL ELECTRIC

LOAD BUILDING



SHEET METAL cabinet components being degreased. It takes two minutes by infrared

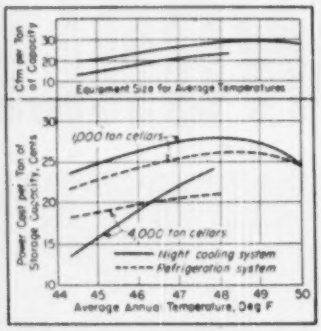
Degreasing Cabinets with Infrared Heat

DOUBLING of degreasing capacity was accomplished by Lee Metal Products, Baltimore, Md., manufacturer of steel cabinets, by installing an infrared unit in the paint spray department. Formerly, degreasing had been a time-consuming operation that presented serious obstacles to production. Parts were carried by hand to a dip vat, lowered into a solvent by a hoist, and again carried by hand to the paint spray area. It was difficult to remove residual solvent from metal seams in order to produce first class painted finishes.

By contrast, the new 180-kw infrared equipment fits into a conveyorized production line and handles double the amount of work with ease. The unit consists of two facing banks of lights, wheel-mounted so that adjustments can be made for work of different shapes and sizes. It can also be removed from the conveyor and wheeled to other locations.

No Preheating Needed

In normal operation, sheet metal components of steel utility cabinets and wardrobes are heated to between 550 and 650 deg—the grease being burned off completely in less than 2 min. Preheating or idling is unnecessary since full operating temperature is attained almost the instant oven lights are turned on, while an open type of construction insures ample circulation of air and simplifies removal of smoke through the exhaust system.



POTATO STORAGE comparison of power costs for average year. Costs favor mechanical refrigeration over night cooling where temperature is above 46.4 F average annually

Air Conditioning Doubles Potato Storage Life

R. A. HOGG
Sales Engineer
Idaho Power Co
Boise

POWER COSTS for operating a mechanical refrigeration system for potato storage are less than for a ventilating system using cool outside air (where annual average temperature is above 46.4 F), according to a study made by Idaho Power Co. Where the average temperature is below 46.4 F, additional fan capacity for a simple ventilating system will consume less power than additional mechanical refrigeration equipment if the cellar is of 4,000 tons capacity and larger.

Potato storage air conditioning, properly designed and installed, reduces storage shrinkage by reducing storage disease, reduces labor costs in sorting by reducing sprouting and spoilage, and by eliminating excess moisture helps preserve wood used in construction of the cellar.

Ordinarily potatoes start to deteriorate after three or four months in cellars without ventilation. With natural cold air ventilation they can be stored six or seven months, and with mechanical refrigeration eight

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

"We no longer purchase conventional transformers"

This testimony of a midwestern operator is backed by his own service records that show "CSP"* Completely Self-Protecting transformers produced these benefits for him:

"lower distribution cost per dollar invested...fewer service trips...better lightning protection . . . fewer transformer burnouts"

Mark this down as sure: complete self-protection *built in* means less dollar investment for distribution facilities. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70522-A

**Trademark—Reg. U. S. Pat. Off.*

PROVE IT YOURSELF with this new book that lets you compare Completely Self-Protecting transformers with conventional types—using your own figures for original investment, installation maintenance, depreciation and interest. Ask for B-4247, "Transformer Costs and Their Relation to Profits".

Call the Westinghouse Salesman

Westinghouse "CSP" TRANSFORMERS

SINGLE PHASE THREE PHASE BANKED SECONDARY

now ALL GUTH for 4-foot

✚ *LIGHT AT THE FLICK OF THE SWITCH*

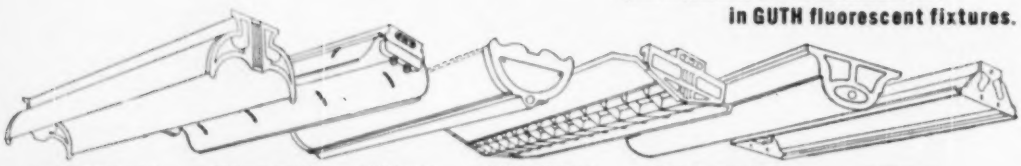
✚ *NO STARTERS*

Here's the biggest fluorescent news in years: you can now use the new 4-ft., 425 ma. T-12 Slimline Lamps in every fixture of the entire GUTH fluorescent line. And the 4-ft. Slimline is efficient! Same lumen output per foot as the 8-ft. Slimline.

Now you have your choice:

- **the 4-ft. Slimline**
- **the 8-ft. Slimline**
- **standard 40-W lamps**
- **standard 85-W lamps**

in GUTH fluorescent fixtures.



FUTURLITER* MAZELITE* CADET* ARISTOLITE* FLU-O-INDIRECT* TROFFERS

FIXTURES

SLIMLINE LAMPS

✚ EASY TO HANDLE

For full details,
call your nearest GUTH resident engineer or write

YOUR TEAMMATE
IN
precision-planned
LIGHTING

TRUCOLITE •

Guth
LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

•

or nine months. Optimum storage temperature is 40 F—below that temperature potatoes become sweet and soggy, above it they sprout.

Night cooling systems use a fan for ventilation and to deliver the quantity of cool outside air required for maximum cooling requirements. Most economical arrangement is a two-speed fan motor so air flow can be reduced, cutting power consumption when ventilation only is required and maximum cooling is not needed. Two motor-operated dampers control the supply of outside air, or recirculation of the cellar air. Thermostats control the dampers so that cold outside air is brought in as needed to mix with inside air.

Size of Refrigeration Unit

Size of a mechanical refrigeration unit is determined by cooling requirements in the spring as outside temperatures rise. This refrigeration capacity plus cooling that may be obtained from the natural cold air by a ventilating fan is sufficient to reduce potatoes to the desired 40 F by the end of the third month of storage, when the heat given off by the potatoes has decreased by 90%. In a 1,000-ton cellar refrigeration system a fan capable of delivering 12½ cfm per ton against one-inch pressure is used; in the 4,000-ton cellar ventilating air is only 7½ cfm per ton.

Night cooling is dependent on weather conditions, affords no control of humidity, and has a higher kilowatt demand than mechanical refrigeration. Mechanical refrigeration is independent of weather conditions, controls humidity, and lengthens the storage time available, but is subject to higher maintenance costs. Power costs for the night cooling system are generally higher, as shown in the accompanying chart.

Bare equipment for either a night cooling system or mechanical refrigeration in Idaho Power Co territory costs between $2.00 and $2.50 per ton of storage capacity. This does not include cost of air ducts and installation, and difference in completely installed prices of the two systems may be small because of different duct work arrangement.

From the standpoint of a utility with a winter peak, the load is desirable. It is at its lowest during the months of December and January.

Function and Decoration Combined

Cutler Sign Advertising Co

LEADING THE VISITOR from outside to inside foyer is this S-shaped run of cold cathode tubes installed in the Rosenau, Inc, building in Philadelphia. Four 25-mm warm-white tubes in the recessed ceiling are covered with egg-crate louvers painted a semi-flat white for high reflectance and low glare. The installation is designed for an illumination of 35-40 ft-c

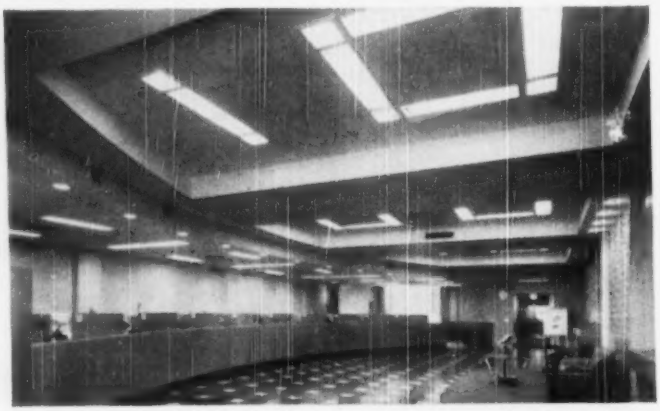
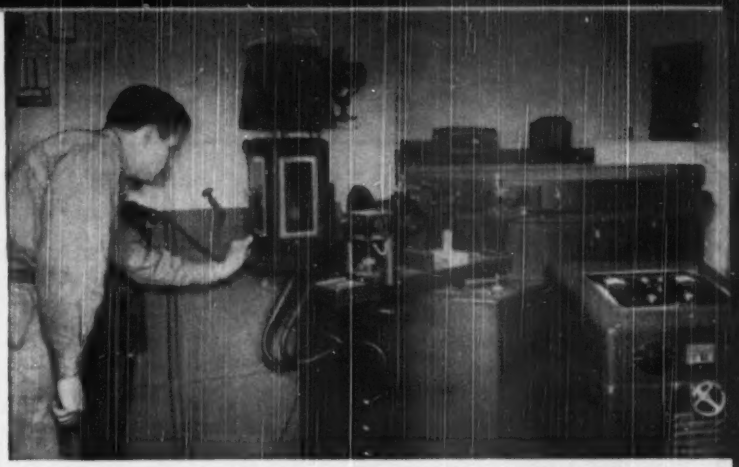


Photo by the Frink Corp

PLEASING AND EFFECTIVE co-ordination of lighting with architectural design is accomplished in the new Fresh Meadows branch of the Jamaica Savings Bank, Flushing, N. Y. Fluorescent troffers in square patterns with incandescent downlights at the corners follow out the rectangular ceiling arrangement. The average intensity is 35 ft-c on the working plane

Only the BEST pass these tests



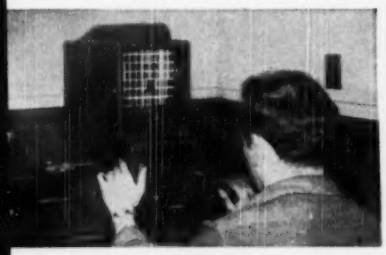
The spectrograph provides one of the most efficient means for precise metallurgical control. Samples taken from a heat in the Driver-Harris melting furnaces are analyzed so rapidly by means of this apparatus, that a complete analysis can be obtained before the next heat is ready for pouring. Thus any necessary adjustments can be made immediately—an outstanding advantage in controlling the constituent elements of alloys being produced to extremely close specifications. The operator is here seen adjusting the size of the analytical gap in the arc-spark stand of the Driver-Harris grating spectrograph at the start of an exposure.

The quality of any manufactured item depends upon a number of factors, but on none so much as "inspection". And here, at Driver-Harris, we give top priority to inspection.

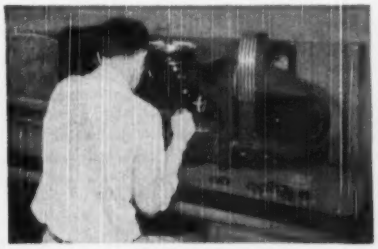
Through every stage of manufacture, precise metallurgical checks and controls are systematically applied to D-H Alloys to insure quality and uniformity that are unsurpassed—recognized the world over.

We have had 50 years' experience in continuous alloy research and manufacture. Every piece of D-H wire, ribbon or strip, and every casting embodies advantages such as only half a century of accumulated know-how can provide.

Whatever your requirements for electrical resistance and heat-resisting alloys, send us your specifications. We shall be glad to make recommendations, and supply you with the alloy best suited to your needs.



This operator is viewing the projection of a series of spectrograms, and is about to measure the intensity of specific spectral lines to determine the quantity of certain chemical elements in the samples being analyzed.



The research metallograph, the ultimate in metallurgical microscopes, is applied to both research and quality control at Driver-Harris.

A view in the Driver-Harris chemical laboratory —fully equipped for all standard types of volumetric, gravimetric and colorimetric analyses.

FIFTIETH ANNIVERSARY

*Makers of over 80 alloys for the electronic, electrical and heat-treating fields—including world-famous Nichrome**

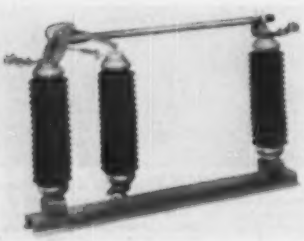
Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

*T. M. Reg. U. S. Pat. Off.

NEW EQUIPMENT



Disconnecting Switch

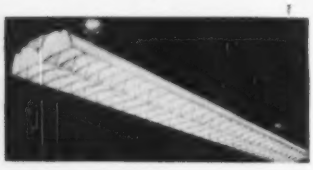
A NEW DISCONNECTING SWITCH, Type 0-2, is available in the complete range from 400 to 4,000 amp and from 7.5 to 287 kv. The manufacturer's statement of features of this switch include:

1. High pressure silver to silver contacts at both clip and hinge.
2. Stainless steel springs that apply pressure and are independent from current path.
3. When closed, the blade is locked by dead center mechanism in the hinge end. The continued rotation of the insulator applies the pressure through a pull rod in the center of the blade, pulling the clip posts to the contact nose, compressing the contact springs to approximately 300 lb pressure and locking the pressure.
4. All linkages for applying pressure and controlling the blade are enclosed.
5. Switch is readily operable with over 1 in. ice build-up.
6. Insulators are relieved of stress when switch is closed.
7. Blades are counterbalanced with torsion springs that will not freeze.

A detailed description is given in Bulletin 46-A.

Cole Electric Co. 8439 Stellar Drive, Culver City, Calif.

•



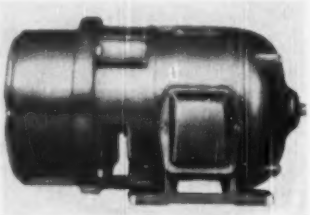
Lamp Fixture

THE BASIC CHASSIS of a new all-metal shielded fixture for T-12 slimline lamps can first be installed, and the entire louver and enclosure assembly then fastened to the chassis. When relamping or servicing, it is not necessary to remove the enclosure or any parts. It is recommended for suspension mounting only, lamps being removable through the top opening.

While designed for two 75-w, 96-in. lamps, the Luvex fixture is also available in sizes for two 72-in., 60-w and two 48-in., 40-w slimline lamps. The unit may also be had for standard 48-in., 40-w fluorescent lamps. Ballast equipment is for 430 ma. Complete information is in Bulletin 10-M.

Day-Brite Lighting, Inc, 5411 Bulwer Ave, St. Louis 7, Mo.

•



Brake Motor and Brake

FOR APPLICATIONS requiring frequent instantaneous stopping and starting, a disk brake has been developed which can be mounted on dripproof, splashproof, or totally-enclosed a-c motors to make a matched brakemotor in ratings from 1 to 60 hp. The brakemotor features pre-lubricated-for-life cartridge bearings and new lining that eliminates the need for adjustments. The bonded metal brake linings are reportedly unaffected by heat, cold, dampness, salt water, grease or oil.

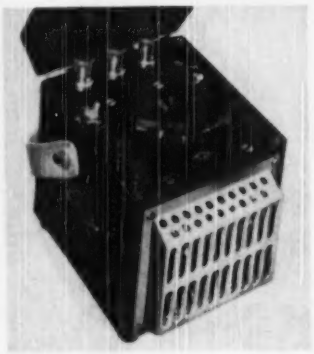
The unit is available separately for mounting on NEMA standard D flange motors in frames 203-326 or C face motors in frames 364-405 with standard double shaft extensions.

Crocker-Wheeler Electric Manufacturing Co, Ampere 5, N. J.

•

Artificial Load

TESTING of polyphase transformer rated watthour meters, and other instruments having a relatively high burden, may be accomplished using the HI-15 artificial load box as a suitable source of current. Current output is 2.5-5-10-15 amp full load and 0.25-0.5-1.0-1.5 amp light load, with an input voltage of 120 or 240 v. Ten and 15 amp values of output current are at 10 v, other current values at 20 v.

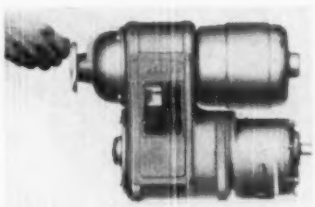


The secondary voltage is said to be so high that virtually all of the circuit impedance is in the load resistors, within the load box. Consequently, changes in the impedance of the external circuit, such as changing from one to three meter elements, will have negligible effect on the current value.

The load box is rated at continuous duty to make it suitable for testing demand meters.

The Eastern Specialty Co, 3617-19 N. Eighth St, Philadelphia 40, Pa.

•



Motor Speed Control

MOTOR, speed varying mechanism, and reduction gears are combined in the 1000 Series Motodrive. Horsepower sizes are $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{2}$ and $\frac{3}{4}$. Ratios of stepless speed variation within 10:1 are available for each size.

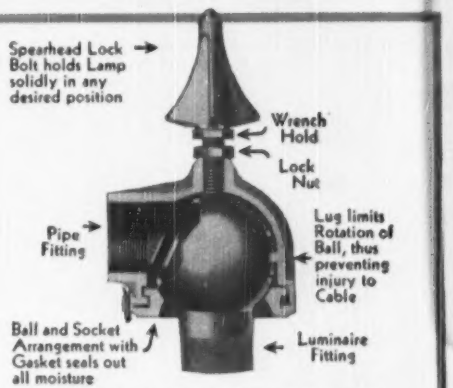
These units are as small in height as $9\frac{5}{8}$ in. in horizontal position and $16\frac{7}{8}$ in. in vertical position. Twenty-four different assembly combinations for vertical or horizontal floor mounting or

the ADJUSTABLE END FITTING for PIPE ARMS

The Hubbard LEVELITE has been designed to provide a much needed flexibility on street lighting installations. Luminaires may be leveled or purposely tilted in any direction, and permanently locked in that position. Many problems in lighting can be solved by this fixture. Poles which are set some distance in from the curb might require a tilt away from the pole to throw more illumination to the roadway. Special conditions such as building obstructions, landscaping, consisting of trees which it is preferred not to trim, and instances where unforeseen changes occur after lines are in service can usually be handled in a practical manner by LEVELITE flexibility.

Mechanical working of the Hubbard LEVELITE is explained by the illustration at the right. A ball and socket movement is used, effectively sealed by a lead gasket. Rigid setting in position is maintained by a single "spearhead" bolt and lock nut. Changes may be made easily and quickly before, during or after installation.

A most popular combination is the HUBBARD LEVELITE and the new HUBBARD UPSWEEP Street Lighting Brackets. Write for a copy of the Hubbard Linebuilder describing these Brackets if you have not already received a copy.


Spearhead Lock Bolt holds Lamp solidly in any desired position
Wrench Hold
Lock Nut
Pipe Fitting
Lug limits Rotation of Ball, thus preventing injury to Cable
Ball and Socket Arrangement with Gasket seals out all moisture
Luminaire Fitting

A MAXIMUM SWING OF 34° IS POSSIBLE IN ANY ONE DIRECTION, 17° IN ANY DIRECTION FROM THE VERTICAL, OR CENTER LINE OF THE LEVELITE.

Stock No.	For Pipe Arm Nominal Size—Inches	Luminaire Attachment Thread—Inches	Approximate Shipping Wt., Lbs., 100 Pcs.
3279	1¼	1¼ (pipe)	563
3281	2	1¼ (pipe)	900
3282	2	2 (pipe)	944

HUBBARD AND COMPANY

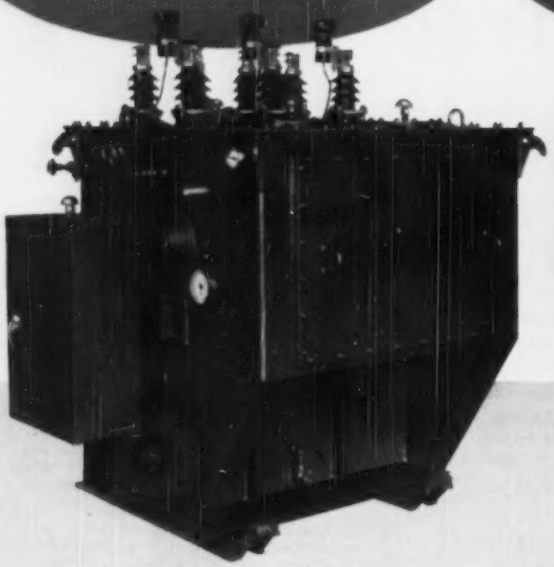
PITTSBURGH · CHICAGO · OAKLAND, CALIF.

PENNSYLVANIA TRANSFORMER

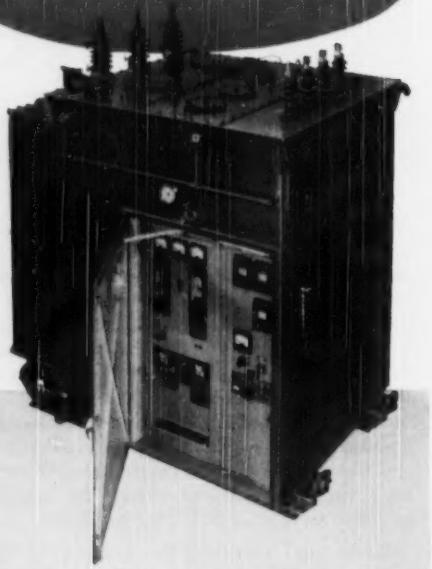
LOAD RATIO

for STEP VOLTAGE REGULATORS

for UNIT SUBSTATIONS



156 Kva Step Voltage Regulator. 12000 Volts. 32-⅝% taps. Total tap range plus or minus 10%.



1500 Kva Single Circuit Unit Substation. High Voltage:-22000 Volts. Low Voltage:-4160 Volts. 32-⅝% taps on Low Voltage winding.

Since 1937 Pennsylvania Transformer Company has been building Load Ratio Control Equipment for customers who desired the design and construction advantages of Pennsylvania Transformers.

About 5 years ago, Pennsylvania Engineers began developing Step Voltage Regulators as well as Single Circuit and Duplex Unit Substations.

For the past few years, Pennsylvania Transformer Company has been taking orders for, and has been building in ever increasing numbers, Load Ratio Control Transformers, Step Voltage Regulators and Unit Substations.

Recently Pennsylvania completed a new, modern Machine Shop designed specifically for manufacturing Load Ratio Control Equipment.

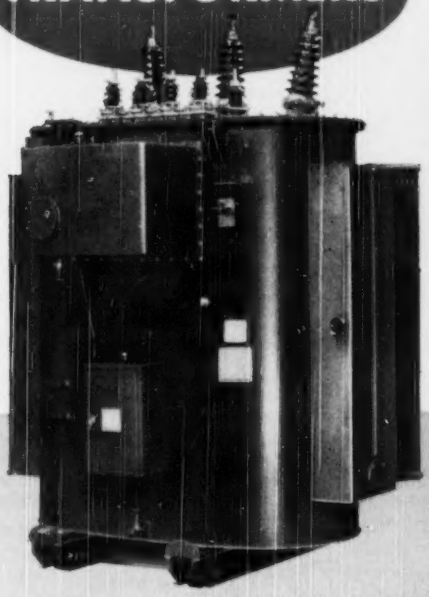
Now Pennsylvania is completely equipped and tooled to build Load Ratio Control Units on a regular production basis.

COMPANY *Announces*

CONTROL

for

TRANSFORMERS



2500 Kva, 3 Phase, 66000-2500/4330Y x 7500/12990Y Volts. Low Voltage winding equipped with 16-15/16% taps for automatic tap changing under load.

Finished units ready for shipment. Reading right to left: 1-239 Kva Step Voltage Regulator; 1-1500 Kva Single Circuit Unit Substation; 4-2500 Kva Load Ratio Control Transformers for multi Unit Substations.

Pennsylvania's modern Machine Shop completely equipped with the latest machine tools for manufacturing Load Ratio Control equipment.

This is Pennsylvania's formal announcement to America's Utilities and Industrials that Pennsylvania Transformer Company is now regularly quoting on all types of Load Ratio Control equipment and Step Voltage Regulators.

Further information can be obtained by contacting a Pennsylvania Representative or by writing directly to Pennsylvania Transformer Company, P. O. Box 330, Canonsburg, Pa.

Pennsylvania

TRANSFORMER COMPANY

CANONSBURG • PENNA.

Greater Pittsburgh District

Pennsylvania TRANSFORMERS

The 7-Range
Clip-On
Volt-Ammeter
FERRANTI
Offers These Important Advantages
• Measures up to 1000 amps - up to 600 volts.
• Convenient ONE HAND operation trigger action.
• Thumb operated range selector switch.
• 7 ranges - 5 current and 2 voltage.
• Insulated case - shockproof construction.
• Takes cables up to 2½" diameter.
• Distinct calibrations - easy to read.
• Suitable for 50-70 cycles.
RANGES 0-10 amps, 0-25 amps, 0-100 amps, 0-250 amps, 0-1000 amps, 0-150 volts, 0-600 volts.
FERRANTI ELECTRIC, INC.
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

DEVALUATION
OF POUND STERLING
REDUCES PRICE OF
FERRANTI
7-RANGE CLIP-ON VOLT-AMMETER

WE are pleased to announce that effective immediately we can offer a substantial reduction in price on this superior instrument. The new low price reflects the full reduction in our cost resulting from the lowered dollar value of the pound sterling. It involves absolutely no change in the superb qualities of the instrument itself. Take advantage of this truly exceptional value now.

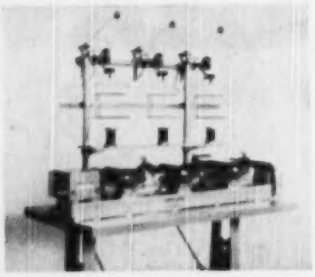
FERRANTI

FERRANTI ELECTRIC, INC.
30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK

horizontal wall mounting are available for each horsepower rating. Motors are squirrel cage induction type, 208, 220/440, or 550 v, 1,800 or 1,200 rpm, 3-phase, 60 cycles. Complete information appears in Bulletin M4917.

Reeves Pulley Co, 1225 Seventh St. Columbus, Ind.

•



Coil Winder

WITH THE HIGH SPEED No. 102 winder it is claimed that an operator can take care of three heads while they are winding coils containing up to 5,000 turns and requiring 30 sec handling time—at a speed of 5,000 rpm. Redesign of the machine, in addition to doubling rpm, has provided for sealing against oil leakage.

Universal Winding Co, 1655 Elmwood Ave, Providence 1, R. I.

•

Corrosion Protection Tape

COLD APPLICATION in a single operation is claimed for Polyken industrial tape, a corrosion protection coating. It is an oriented polyethylene film with synthetic adhesive applied to one side. The pressure used in applying the tape is said to be permanently maintained.

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

CURRENT TRANSFORMER
Only two of these CT's required to meter 10 to 800 amp range

ADJUSTABLE-SPEED DRIVES
Continuous adjustment from 290 to 2,300 rpm at rated output

SPLASH-PROOF MOTORS
Designed for locations subject to direct streams of liquid

LOCATING SPOTLIGHT
Intended for work positioning for welders, riveters, etc

LIGHTING TRANSFORMER
New-type insulation among improvements; ratings to 15 kva

FAULT LOCATOR
Pulse type locator is for high resistance cable faults

The design of Penn-Union Multifit Connectors retains the full strength and rigidity of the Everdur bolt. The saddle which provides a wide surface to grip and protect the cable is permanently fastened to the U-bolt; one piece. The strongest and most satisfactory fitting of this type. High copper content alloy; Everdur Nuts and Lockwashers as well as Bolts.

★ Each Multifit Connector takes a wide range of conductor sizes; only a small stock will provide for many needs. Made in a complete range for cable up to 2,000,000 cm.

The Penn-Union line also includes numerous other types of Tees, Lugs and Straight Connectors, as well as Service Connectors, Bus Supports, Grounding Clamps, Cable Taps, etc., etc. Experienced users have found that the Penn-Union mark on a fitting is their best guarantee of satisfactory performance.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION

Erie, Pa.

Canada: Dominion Cutout Co., Ltd., 250 Richmond St. West., Toronto, Ontario

THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

TOP: General view of the protected area.

CENTER: Foam discharge at the rate of 2 in. per min.

BOTTOM: Area covered by 6 in. of foam blanket in 3 min.

it's NEW!

"Automatic" AER-O-FOAM PROTECTION FOR INDUSTRY

For many years fire protection engineers have been faced with the problem of finding a feasible answer to the hazard caused by crowded plant facilities where flammable liquids are involved. Conditions of this type exist in many chemical processing industries, metal working plants, petroleum storage and handling and electric power generation properties. A severe hazard was evident at the Schenectady Varnish Company, Schenectady, N. Y., where fire at the tank car loading racks and storage facilities presented a constant threat to the operation of the entire plant.

Having had a background in the development of all types of automatically operated fire protection equipment, "Automatic Sprinkler" engineers designed and installed the mechanical foam system, test photos shown above, and which is now commercially identified as "Automatic" AER-O-FOAM.

The important engineering advantages of this form of protection are evident in the improvement of drainage conditions, reduction of water supply requirements, non-corrosive action of the foam material, positive fire extinguishment and prevention of reflash. As "Automatic" AER-O-FOAM dehydrates rapidly following application, clean-up operations are held to a minimum.

Fuel oil storage, oil cellars and many other hazards familiar to power generation can now be positively protected through the media of "Automatic" AER-O-FOAM. Your nearest "Automatic Sprinkler" representative will be glad to show you how and—at no obligation to you. Write or call today for descriptive literature.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 6, OHIO

"Automatic" Sprinkler
FIRST IN FIRE PROTECTION
DEVELOPMENT - ENGINEERING MANUFACTURE - INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

preventing the flow of moisture between tape and protected metal. Some properties of the coating are listed.

Property	Value
Insulation Resistance (ASTM D-257-46)	10^6 megohms
Dielectric Strength, 10,000 v rms (ASTM D-149-44 @ 500 v/sec voltage rise)	1,400 vpm avg
Moisture Absorption (30 C and 100% R.H.)	0.1%
Operating Temperature Range (Good dimensional stability)	(—40 to 100 C)

Aluminum and black colored tape, 0.009 in. thick, is available in 100 ft rolls.

Plastic Engineering & Sales Corp, P. O. Box 1037, Fort Worth, Tex.

•

Telescopic Tower

THREE OF FOUR telescopic sections (keyed to each other to prevent rotation) and an inner hydraulic element comprise a truck tower which can be raised and lowered at about 40 fpm. Operation is by means of a hydraulic pump driven from a power take-off attached to the truck transmission.

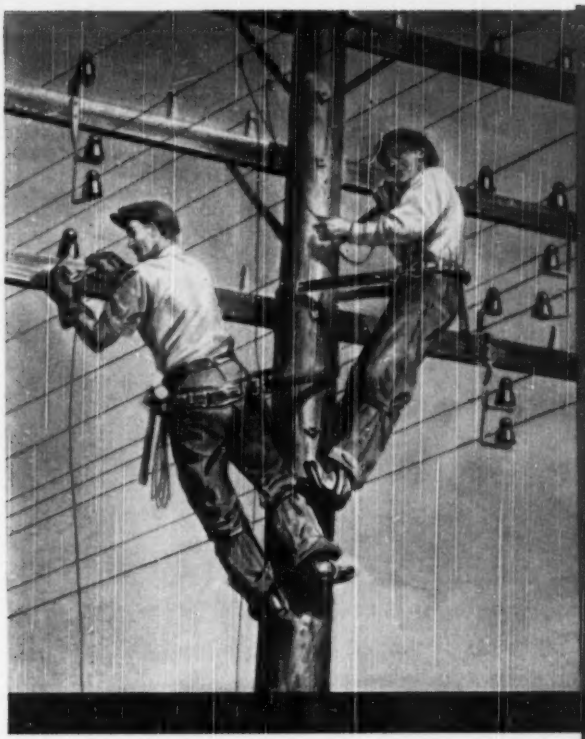
Raised heights, above chassis frame, of the two models are 17 ft 6 in., and 26 ft 8 in.; lowered heights are, respectively, 7 ft 10 in. and 8 ft 5 in. The platform is 4x9 ft and rotates 360 deg. Except for the insulation, platform floor and the railing, construction is of steel. To level and stabilize the truck, a hinged jack is provided on each side. Further details are in Bulletin 1829P2.

Silent Hoist & Crane Co. Inc, 841-877 63d St, Brooklyn 20, N. Y.

•

Explosion-Proof Motor

SQUIRREL CAGE, totally enclosed, type CSP motors have been designed for constant speed drive applications, such as pumps, blower, or compressors, where Class I Group D explosive materials



for clean crossarms that last longer!

Specify penta-protected Crossarms

chlorophenol

Here's one way to cut maintenance costs. Specify PENTA-treatment for all crossarms. A low-cost PENTA-treatment gives crossarms effective protection against pin hole decay and end rot, chief causes of crossarm replacement.

PENTA's low solubility and volatility mean less leaching and "cooking" out under adverse climatic conditions—assure long lasting protection.

Men like to work with "PENTA-treated" wood. It's clean, easy to handle and nonirritating.

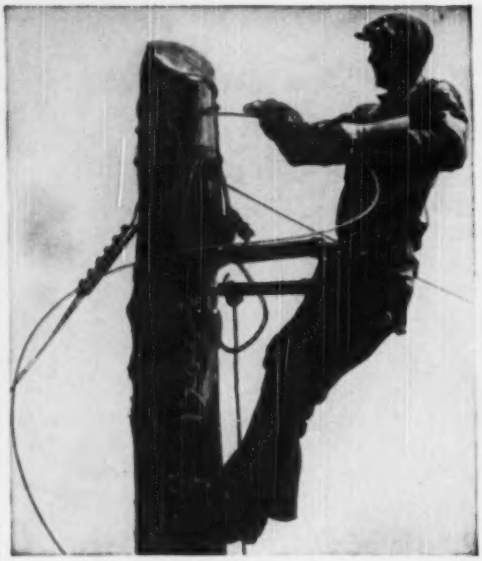
For technical information about PENTAchlorophenol, consult your treater or write to Dow, Dept. PE 14.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

THE CLEAN WOOD PRESERVATIVE

DOW penta- chlorophenol

Has What It Takes



For Guys, Messenger and Overhead Ground Wire

EXPERT linemen know, when they use *Crapo* Galvanized Steel Strand, that it will meet every requirement the job demands. For *Crapo* Galvanized Strand "has what it takes" — *strength, ruggedness, workability, long-life.*

These essential characteristics, combined with ever important ECONOMY, make *Crapo* Galvanized Strand first choice for guys, messenger and overhead ground wire. The superior tensile strength of the steel is utilized to fullest advantage in each size and grade. The heavy, ductile, tightly-adherent galvanized coating — applied by the famous *Crapo* Process — provides dependable protection for the steel, prolongs the expectant life of the strand.

The all 'round reliability and overall economy of *Crapo* Galvanized Strand are matters of record with leading strand users. Such records contain ample and significant proof of the long life and low annual cost of this strand in service.

Available for Prompt Delivery

There is a size and grade of *Crapo* Galvanized Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write for further information!

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

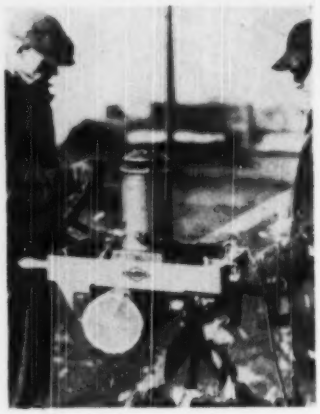
Crapo GALVANIZED STEEL STRAND

or atmospheres are encountered.

Special primer, thermoset varnish and nitrocellulose base finish are used in addition to heavy steel construction. Ball bearings are pre-lubricated. The motors are available in frames 224 to 326, in one to 20-hp ratings, for 2- and 3-phase, 25-, 50-, 60-cycle, 208-, 220-, 440-, 550-v service.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

•



Pole Gain Saw

FAST POLE MATCHING in one operation that eliminates slower hand methods is claimed for a new pole gain saw. High speed revolving knives, replaceable although said to last indefinitely, do the actual cutting. The saw, powered by a 1½ hp motor, has a cast aluminum frame so that one man can carry it from job to job, and two men can operate it.

Diamond Iron Works, Inc, Dept x107, 1728 Second St N., Minneapolis, Minn.

•

Grounding Clamp

UP TO 600 AMP can be handled by a permanent Alnico magnet used as a clamp for the grounding of electric welders. Called the MagnaGround, it can be attached with either set screws or by silver soldering.

The clamp can be applied on any magnetic surface, vertical or horizontal, and the magnet is said to hold it fast. It is also useable on non-magnetic stainless steel.

Dings Magnetic Separator Co, 4740 W. Electric Ave, Milwaukee 14, Wis.

•

Incandescent Luminaires

CONCENTRIC LOUVERS, for both semi-indirect and indirect illumination, are featured in a new series of incandescent luminaires. Included in the line are

It's This Heavy Duty Spring That Makes the Big Difference in FARGO AGE SERIES HOT LINE CLAMPS!

AND HERE'S WHY:

It's this heavy duty spring that makes up for the variables caused by fault currents . . . atmospheric changes . . . load variations—and the tendency of the conductor to "relax" or "flow" while under stress.

Again, it's this heavy duty spring that compensates for the different torque linemen use in tightening connections.

Last—but by no means least—it's this heavy duty spring that makes the Fargo AGE Series Hot Line Clamps vibration-proof!

You'll discover, too, that Fargo AGE Series Hot Line Clamps have contact area enough to avoid heating as a result of fault currents—yet, they're light enough to be easily and quickly installed at the end of a stick.

Like other products bearing the Fargo name, the AGE Series Hot Line Clamps are built of the finest materials to meet the exacting requirements of Utility operations and give the maximum in performance.

		RUN WIRE (Copper)		TAP WIRE (Copper)	
		Max.	Min.	Max.	Min.
All-Purpose Cast Bronze (plated)	AGE–0	#2 Str. Cu.	#8 Sol. Cu.	#2 Str. Cu.	#8 Sol. Cu.
	AGE–1	250,000 CM Cu.	#6 Sol. Cu.	#2/0 Str. Cu.	#6 Sol. Cu.
	AGE–2	750,000 CM Cu	#4/0 Str. Cu.	250,000 CM Cu.	#6 Sol. Cu.
		RUN WIRE (Aluminum)		TAP WIRE (Aluminum)	
		Max.	Min.	Max.	Min.
Cast Aluminum	AGE–0A	#2ACSR	#8 Sol. Alum.	#2ACSR	#8 Sol. Alum.
	AGE–1A	250,000 CM Alum.	#6 Sol. Alum.	#2/0 Str. Alum.	#6 Sol. Alum.
	AGE–2A	750,000 CM Alum.	#4/0 Str. Alum.	250,000 CM Alum.	#6 Sol. Alum.

Note: AGE Series Hot Line Clamps are also available for Aluminum-to-Copper Connections.

FARGO

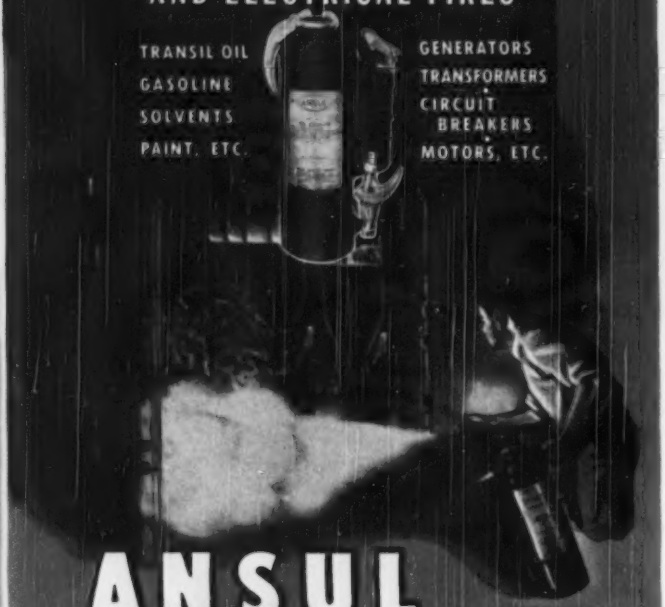
LM

Your Best Protection

FOR FLAMMABLE LIQUID AND ELECTRICAL FIRES

TRANSIL OIL
GASOLINE
SOLVENTS
PAINT, ETC.

GENERATORS
TRANSFORMERS
CIRCUIT BREAKERS
MOTORS, ETC.

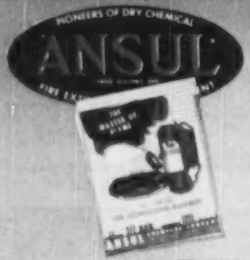


ANSUL
DRY CHEMICAL
FIRE EXTINGUISHERS

They're most dependable too! Years of field service protecting all kinds of Electrical Equipment has resulted in outstanding design features available ONLY in Ansul Dry Chemical Extinguishers.

FIRE PROTECTION by the dry chemical method has proved *Most Effective* as well as *Most Economical*. And only Ansul offers a complete line of hand, wheeled and stationary dry chemical fire extinguishers. Investigate Ansul Piped Systems for protection of special hazards.

Send for File No. 509. You will receive a variety of helpful printed matter. Included is our latest catalog which describes Ansul Extinguishers of all sizes — from the small Ansul Model 4 to Ansul Piped Systems and Ansul 2000 lb. Stationary Units.



ADVANTAGES

1. Quick, Positive Extinguishing Action.
2. Easier on the Spot Recharge (No special tools needed).
3. No Annual Recharge Necessary.
4. Low Maintenance Costs.
5. ANSUL PLUS-FIFTY Dry Chemical used Exclusively.
6. Long Range Stream.
7. Effective in Winds and Drafts.
8. Stream pattern forms heat shielding screen to protect operator.
9. Listed and Approved by Underwriters' Laboratories, Inc., and Factory Mutual Laboratories.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN PRINCIPAL CITIES IN THE UNITED STATES, CANADA, AND OTHER COUNTRIES

pendant and ceiling types up to 23 in. diam and finished in Alzak aluminum. Direct-indirect types are made for semi-silvered bowl or Type C lamps, 300 to 500 w.

The "concealed indirects" for silver bowl lamps are also available as recessed lamps furnished with spun steel ceiling finishing ring and metal plaster ring. Depth in ceiling is 11 in., hole diam 22¾ in. Complete line is described in Bulletin No. 864.

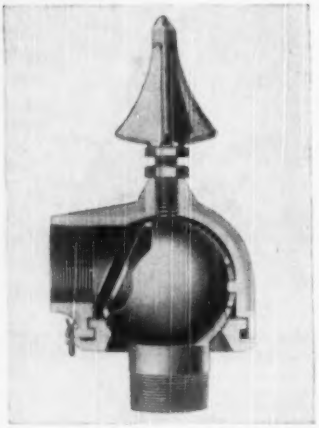
The Edwin F. Guth Co, 2615 Washington Ave, St Louis 3, Mo.

•

INSTRUMENT RECTIFIER—A gold-to-gold internal circuit arrangement is featured in a copper oxide rectifier for instrument application. Said to be totally new, the model CX-14 series has vacuum-processed rectifier plates with gold contacts, measures ½ x ⅝ x ¼ in. and mounts on one 2-56 x ⅜ screw.

Bradley Laboratories, Inc, New Haven, Conn.

•

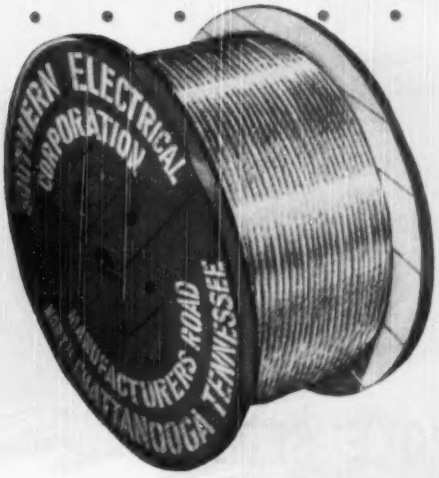


Luminaire Leveler

Lighting fixtures may be adjusted to any angle up to 17 deg in any direction from the vertical with the Levelite. Another advantage claimed for this unit is a lack of obstructions to retard the passage of internal wiring as it is pushed through the fixture.

A ball and socket movement, sealed by a lead gasket, is used. Rigid setting in position is maintained by a single ¾-in. "spearhead" bolt and lock nut. The ball, of the ball and socket arrangement, is prevented from turning so far

One call---gets all---



GET ACSR CONDUCTORS AND ACCESSORIES DIRECT FROM SOUTHERN'S MILL AND SAVE MONEY, TIME, AND WORRY

ACSR CONDUCTORS

Southern Electric's ACSR Conductors are built to the highest specifications and are laboratory tested to insure constant uniformity, increased strength, and the economy of higher tensions and longer spans. Immediately available in 4 ga. to 2,000,000 C.M.

BARE COPPER WIRES AND CABLES

A full range of standard strandings is manufactured in sizes from 14 ga. to 2,000,000 C.M. Weatherproof copper wire and cable in all regular sizes also available for prompt shipment.

GALVANIZED STEEL STRAND

Highest quality, extra galvanized steel strands for guys and overhead ground wires is manufactured and stocked in all grades, sizes, and constructions and shipped in coils or reels.

ACSR ACCESSORIES

Large stocks maintained for immediate shipment with conductors, so that "one call, gets all." You avoid construction delays and need to place only one order direct with Southern Electric's mill. A complete assortment of sizes is maintained on Armor Rods, straight and preformed; Twisting Joints, Tie Wires, Flat Aluminum Tape, Clips, Clamps and Dead Ends.

A phone call, wire, or letter will bring you full details and a firm delivery date that you can depend upon.

PHONE
7-3325
WRITE
P. O. BOX 989

SOUTHERN
Electrical
Corporation
CHATTANOOGA TENNESSEE

Introducing

COBRA WOOD POLE SERVICE

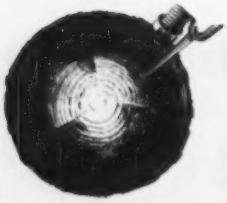
to America

Yes, Cobra is new to the U. S. A. But it comes with the history of satisfactory use on more than two million poles in Europe, many of them in service after twenty years.

Cobra Service reduces pole line maintenance by increasing the life of saveable poles by twenty years on the average. It is a complete service including the testing of all poles on the line at a nominal cost and treatment of saveable poles at a cost of less than ten dollars per pole including excavation and refill.

Cobra treatments differ from all others in that a combination of water soluble salts is injected deeply into the heartwood and continue to diffuse for months after treatment.

Ask for a copy of the inspection report, certified experience records, laboratory tests and complete technical data.



COBRA
WOOD-POLE
SERVICE

COBRA WOOD TREATMENT CORPORATION
124 EAST 40TH STREET • NEW YORK 16, N. Y.

as to bind or jam against the conductor by a lug which limits maximum travel.

Hubbard & Co, 6301 Bugler St, Pittsburgh 1, Pa.

•

Car Heater

WINTER COMFORT for drive-in theater patrons is reportedly provided in the form of a 200-w heater that hooks over the top of the car window. The 2½-lb. waterproof heater, operating from 220 v, is attached to a 10-ft cord and mounted on a post below the loud speakers.

National Heaters, Inc, 1647 Victory Blvd, Glendale, Calif.

MORE NEW PRODUCTS
about which you should know

FEDERAL ELECTRIC PRODUCTS CO., NEWARK, N. J., has announced a 100-amp **pull switch** said to be completely dead-front; even with the puller head out, a phenolic shield covers all the live parts. . . . Also annouced by the company is a **circuit breaker panel** employing Quicklag circuit breakers in a calibrated range of 15, 20, 30, 40 and 50 amp, and cabinets with 2, 4, 8, 16 or 20-circuit breaker capacity.

GLEASON-AVERY, INC, AUBURN, N. Y., has designed a worm-drive **motor assembly** in speed ranges from 25 to 400 rpm, for advertising displays, coin operated machines, and similar small-size applications. . . . TEMPIL CORP, 132 W. 22ND ST, NEW YORK 11, N. Y., has extended its line of **temperature indicating pellets** to 2,500 F; previously available in steps from 113 to 2,000 F.

BERKSHIRE LABORATORIES, P.O. BOX 70W, CONCORD, MASS., has introduced

AMERTRAN POWER TRANSFORMERS

A "jack-of-all-trades" has his points. Yet, on any job he may undertake, he is not likely to get quite the results that one who concentrates in that same field can accomplish. It means something, therefore, that AmerTran has given its undivided attention for almost a half-century to transformers and closely related products. During that time we have produced the best transformers that concentrated experience can devise.

Who says so?

Our customers say so—and the evidence is in their repeat orders. You, too, will find it pays to specify AmerTran in your transformer requirements.

AMERICAN TRANSFORMER CO.
178 Emmet St., Newark 5, N. J.

30 YEARS
of increased
demand -
PROVE THE EXTRA DEPENDABILITY
of
ACCURATE
FRICTION AND RUBBER
TAPES

MATERIALS — A major factor in the expanding demand for Accurate Tapes. Only finest grade cotton sheeting, purest live rubber are used in their manufacture. Result — permanent pliability, extra stretch, maximum cohesion — all important to clean, fast, economical taping.

WORKMANSHIP — Accurate Friction Tapes are super-calendered for complete impregnation of the base cloth. Careful slitting prevents tape from raveling when used. Accurate Rubber Tapes are specially compounded with unusual precautions taken to maintain caliper, elasticity and fusing characteristics.

QUALITY CONTROL—Every production run must fully meet fourteen exacting quality control checks. These tests guarantee the quality of every roll shipped — are the big reasons why Accurate tapes have increased in popularity every year for over 30 years.

READY NOW!
ACCURATE
CATALOG

Contains complete specifications on all Accurate types, including roll lengths, and packaging. Get your copy today! Just call or write —

ACCURATE
MFG. COMPANY
Garfield, New Jersey

IF IT'S TAPE... IT WILL PAY YOU TO MAKE SURE IT'S ACCURATE TAPE

a **wave shaping device** used to produce time marks in cathode ray oscillography; it converts a sinusoidal input voltage into a series of short unidirectional pulses. . . . HOBART BROTHERS CO, HOBART SQ, TROY, OHIO, is producing a **switch** which shuts off, or turns on, the arc welding machine when the electrode holder is, respectively, hung up or picked up.

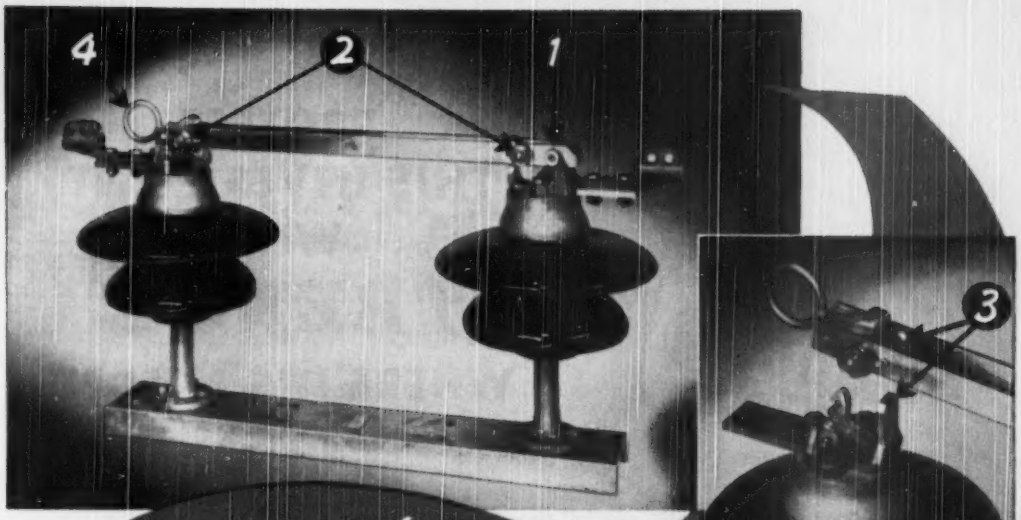
REEVES PULLEY CO, COLUMBUS, IND., has developed a **hydraulic control** for use on Reeves Motodrive to provide means for automatically controlling tension, pressure and temperature, and to synchronize operating speeds of machines in the production line or of parts of the same machine. . . . WILLARD STORAGE BATTERY CO, CLEVELAND, OHIO, is offering a **battery capacity tester** adjustable to both size of battery and temperature of the electrolyte.

WESTINGHOUSE ELECTRIC CORP, P. O. BOX 2099, PITTSBURGH 30, PA., is offering a line of machine-tool control **transformers** in seven sizes from 0.075 to 1.5 kva, 220/440—110 v, 60 cycles. . . . BAKELITE CORP, 30 E. 42ND ST, NEW YORK 17, N. Y., has announced a new type of refrigeration **supply cord** consisting of two No. 18 or 16 stranded conductors laid in parallel and covered with Vinylite insulating compound.

BURNHAM CORP, ELECTRIC RADIATOR DEPT, IRVINGTON, N. Y., offers an explosion-proof electric **radiator**, thermostatically controlled, for use in Class 1, Group D and Class 2, Groups F and G atmospheres. . . . CARLSON & SULLIVAN, INC, MONROVIA, CAL., is making a **rule** which automatically converts circumferences into diameters up to 21 in.; can be used for poles, pipe, cable, shafts, etc.

THE KIRK & BLUM MFG CO, 2838 SPRING GROVE, CINCINNATI 25, OHIO, has designed heavy duty portable **dust collectors** with 450, 900, and 1,800 cfm velocity; exhauster is direct connected to a 3,600-rpm, 220/440-v motor. More information in Bulletin 72M. . . . THE ARO EQUIPMENT CORP, BRYAN, OHIO, is making a portable **mixing motor** for mixing, emulsifying or stirring operations in industrial plants; five motors are available with speeds of 500, 1,200, 2,800, 4,500, and 17,000 rpm.

AERO-MOTIVE MFG CO, 1803 ALCOTT ST, KALAMAZOO 24, MICH., has an electric **cord reel**, Model SW-25, that is equipped with a swivel mounting to reduce wear when the cable is pulled sideways. . . . THE DUNMORE CO, RACINE, WIS., is producing a 12½-oz **hand grinder** for light industrial applications; rating is 1/40 hp, 115 v a-c or d-c.



A New HI-VOLTAGE HOOK OPERATED SWITCH...

with 4 CONSTRUCTION FEATURES THAT ASSURE CERTAIN OPERATION

Here is an entirely new line of out-door, hook-operated disconnecting switches built by Hi-Voltage. These switches are manufactured in all capacities from 400 to 2000 amperes and 7,500 to 115,000 volts.

This new line incorporates four construction features in keeping with the traditional high quality and certain operation afforded by all Hi-Voltage Switches.

Look over these advantages . . . they are reasons for the continued superiority of Hi-Voltage in the air switch field.

1. ***Independently Hinged Blades***—On the 400 to 1200-ampere switches, the blades are carried on a hinge which is entirely independent of the hinge end contact. In this manner, misalignment sometimes resulting from installation, cannot affect the smooth operation or the positive conductivity of these switches.

2. ***Stainless Steel Contact Springs***—On all switch models, contact pressure is maintained by stainless steel compression springs of ageless flexibility. Moisture cannot rust them, nor interfere with the maximum conductivity they develop.

3. ***Silver Nickel Contacts***—On all switch models from 600 to 2000 amperes, contacts are silver-nickel welded to copper . . . non-gauling . . . corrosion proof . . . best for conductivity.

4. ***Pry-Off Lock Action***—The lock is strong and positive. Its pry-off action guarantees easy opening under ice conditions and when the location of the switch necessitates a pull with the switch stick almost parallel with the blade.

Get the complete story of the new line of Hook Operated Switches from your Sales Engineer.

HI-VOLTAGE **EQUIPMENT COMPANY**

4000 EAST 116TH STREET • CLEVELAND 5, OHIO

PROTECT
THIS INVESTMENT
WITH
STRENGTH
WHERE IT'S NEEDED
$300,000.
$1,500,000.

I-T-E ISOLATED PHASE BUS STRUCTURES GIVE COMPLETE, DEPENDABLE PROTECTION —*COST BUT A FRACTION OF THEIR WORTH!*

Factory layout of Delta Bus for large hydro-electric power plant.

● In any generating station, the actual *worth* of the conductor between generators and transformers is in direct proportion to the cost of the connected equipment. That's why I-T-E *Isolated* Phase Bus Structures are such attractive bargains.

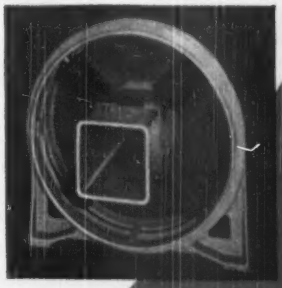
I-T-E *Isolated* Phase Bus gives you a greater margin of safety under even abnormal operating conditions. The *complete* isolation of phases eliminates the possibility of phase-to-phase faults. And the unique design of I-T-E *Isolated* Phase Bus gives you a structure that is permanently strong, permanently dependable *at no extra cost!*

Every I-T-E Bus Structure is custom-built for the installation that is to receive it. All components are designed, fabricated, coordinated, and tested by I-T-E *before* shipment—the structure is delivered ready for quick, easy installation.

When you consider that I-T-E Isolated Phase Bus Structures give you maximum protection for connected equipment, complete safety to operating personnel, greater continuity of service, no maintenance expense, *and that they cost but a fraction of your total plant investment,* you'll agree: I-T-E Isolated Phase Bus is *your best conductor buy!*

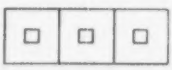
◀ Built-to-specification section of bus structure, showing conductors projecting from complete housings, and ground-bus paralleling conductor-bus.

Standard 4 insulator ring arrangement which supports conductor throughout length of bus run. ▶



THIS DIFFERENCE MEANS EXTRA SAFETY:

Fig. 1



In ordinary segregated phase bus (Fig. 1), separation between phases is usually accomplished with a single-thickness metal barrier. A severe arc between the conductor and this barrier may burn through and permit ionized gases to enter the compartment of the adjacent phase. This usually causes a phase-to-phase short circuit.

Fig. 2

However, in the I-T-E *Isolated* Phase Bus Structure (Fig. 2) each conductor is encased in an individual, non-magnetic metal housing. *And each housing is separated from adjacent housings by an insulating air-space.* With this I-T-E *isolated* phase construction, phase-to-phase short circuits are practically eliminated, all for the same cost.

SEND FOR FREE BOOKLET—Contains complete information on uses, construction, and installation of I-T-E Isolated Phase Bus Structures, as well as convenient data and suggestions for planning a bus layout. Write, requesting Catalog 10147; or, ask your local I-T-E Representative.

I-T-E

ISOLATED PHASE BUS STRUCTURES

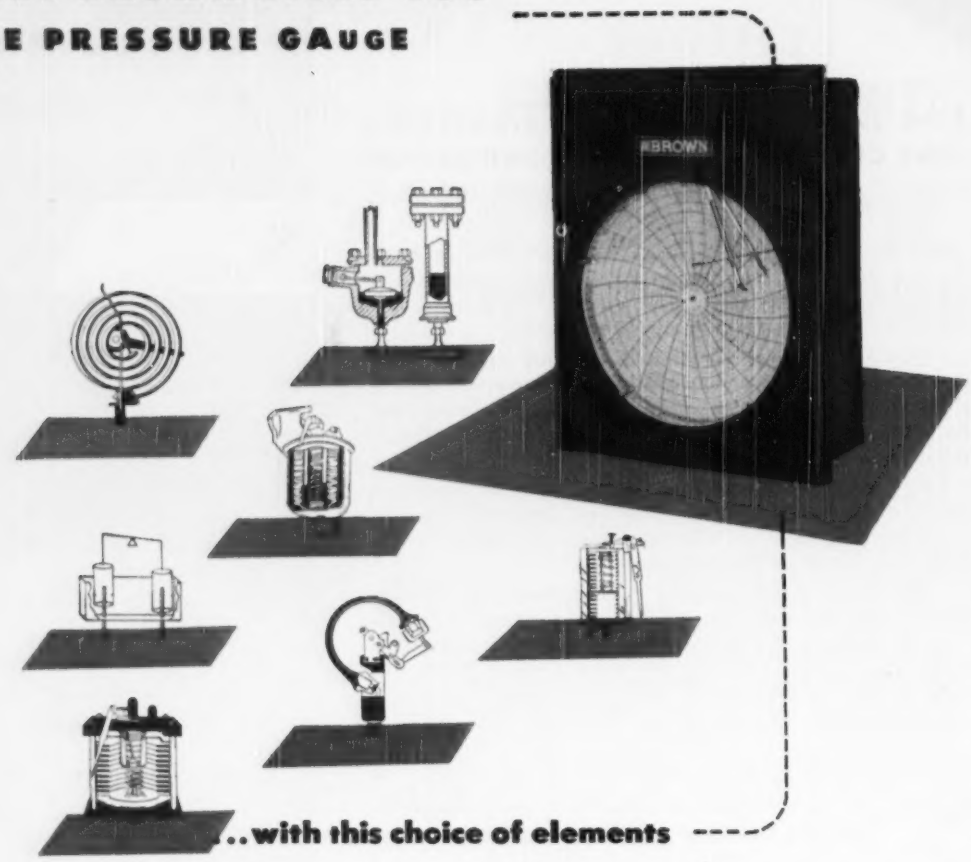
I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Power Switching Divisions: Railway & Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Canadian Power Apparatus, Ltd., Toronto — Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CURRENT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

ONLY BROWN GIVES YOU THE PRESSURE GAUGE



..with this choice of elements

THE BROWN PRESSURE GAUGE has long been the standard of comparison for almost all of industry . . . because of its continuous, trouble-free performance and its unmatched sensitivity.

Its performance is the result of engineered design, rugged construction and simplicity of operation. The wide range of measuring elements is responsible for its sensitivity. There's a specific element for every pressure application . . . from microns to tons . . . from corrosive to non-corrosive.

Your local Honeywell engineer is as near as your phone. Call him in for a discussion of your pressure problems . . . or write for a copy of Catalog 7000!

WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL · COMMERCIAL · RESIDENTIAL · INDUSTRIAL

MINNEAPOLIS-HONEYWELL REGULATOR CO.
BROWN INSTRUMENTS DIVISION
4568 Wayne Ave., Philadelphia 44, Pa.
Offices in 77 principal cities of the United States, Canada and throughout the world

Honeywell — *Advanced Instrumentation* FOR BETTER PROCESSING — BROWN

NEWS ABOUT PEOPLE

Parrott Made Consultant by Ebasco Services, Inc

William E. Parrott, manager of the sales and market department of Ebasco Services, Inc, since 1941, has been appointed a general consultant. Paul D. Brooks will succeed him as sales and market manager.

W. E. PARROTT

Parrott started his utility career in 1919 when he joined Idaho Power Co in the sales, accounting, and operations field after completion of a student training course. Later he handled construction projects and divisional operations. He left Idaho Power in 1929 to join Compania Cubana de Electricidad, Havana, Cuba, as a sales consultant. In 1932 Parrott became general sales manager of Memphis Power & Light Co and in 1935 sales sponsor for the Northwest group of Ebasco client companies.

Brooks in 1929 was employed by Tennessee Public Service Co, Knoxville, Tenn., where he served in all divisions of the sales department, was an operating division manager, general sales manager, and a director. He was named Southwest sales sponsor of Ebasco in 1938 and assistant manager of the sales and marketing department in January, 1944.

•

Mrs Mary Reynolds Riedel has been appointed director of women's activities of Proctor Electric Co, Philadelphia. She will continue to direct the company's publicity and public relations department. Mrs Riedel, who joined Proctor 12 years ago as part-time secretary, during the war established the first all-women service station in the country for the repair of electrical appliances. She was responsible for the company's sponsorship of "sit-down ironing the Mary Proctor way."

•

Iowa Utilities Association Elects Kapp as President

M. L. Kapp, executive vice-president of Interstate Power Co, Dubuque, has been elected president of the Iowa Utilities Association.

M. L. KAPP

Harold L. Mann, executive vice-president of Iowa Southern Utilities Co, Centerville, was named first vice-president and Sutherland Dows, president of Iowa Electric Light & Power Co, Cedar Rapids, second vice-president. Ben A. Webster was reelected secretary-manager.

Kapp began his utility career in 1918 with Chandler (Okla.) Electric Co as office assistant and meter reader. From 1920 to 1936 he was employed by Oklahoma Natural Gas Co, as traveling auditor, district manager, supervisor of managers, and assistant to the vice-president.

In 1936 Kapp joined Michigan Public Service Co, Traverse City, as operating superintendent and member of the board of directors. He was vice-president of that utility in 1939 when he joined Interstate as assistant to the president. He was elected a director of Interstate in 1940, vice-president in 1945, and executive vice-president in 1949.

Barclay New Engineering Manager of J. G. White

Robert H. Barclay, chief electrical engineer of J. G. White Engineering Corp, New York, has been named engineering manager of the company. He will be responsible for the management of all engineering activities.

ROBERT H. BARCLAY

Barclay is chairman of the Committee on Professional Recognition of the Engineers Council for Professional Development. He spent seven years with the Federal Power Commission, as chief of the analysis and reports division of the National Power Survey and as New York regional director.

He joined White in 1941 as chief electrical engineer in charge of the electrical engineering division. Earlier he had spent three years as assistant electrical engineer for Kansas City Terminal Railway Co, Kansas City, Mo.; two years as assistant engineer for Brooklyn-Manhattan Transit Corp, Brooklyn, N. Y.; five years as chief electrical engineer for the Foundation Co, New York; two years as chief electrical engineer of Starrett & Van Vleck, New York architects; and seven years as electrical engineer with Stone & Webster Engineering Corp, Boston.

From 1931 to 1934 he was president of McClelland Barclay Art Products, Inc, New York, manufacturer of art objects and seller of paintings and illustrations made by his brother, McClelland Barclay.

Barclay is a fellow, life member, and member of the board of examiners of

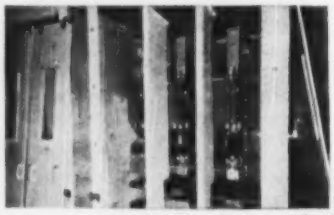
SOLVE YOUR HIGH-VOLTAGE ELECTRICAL-EQUIPMENT HOUSING PROBLEM

-with Trancell Materials

You'll find—as others have—that it is easy, fast, safe, and economical to use Johns-Manville Trancell for solving the problem of equipment housing in your station expansion program . . . and you'll find, too, that Trancell Materials make a smart, efficient-looking station.

Faster to install — Trancell cuts easily, and can be quickly drilled right on the job with regular tools.

Easier to install—Trancell's light weight and strength make it easy to handle, easy to mount without framework.



Economical to install — Trancell's ease of fabrication and installation keep station expansion and future maintenance costs down.

Safer to install—Trancell is a non-metallic asbestos-base material . . . installed dry. It adequately isolates high-voltage equipment from fire and excessive heat.

Attractive when installed — Trancell makes up into neat, attractive, flush-type housings, panels, doors, and partitions that require no painting.

—for all high voltage power equipment enclosures — Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions, bus bar enclosures, and other electrical services. For further information write Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville

TRANCELL

an asbestos product for housing electrical equipment

the American Institute of Electrical Engineers; a former chairman of the Engineering Societies' Library Board; a fellow of the Radio Club of America; and a member of the Society of American Military Engineers.

•

New Anaconda Sales Job Given to David E. Allen

David E. Allen has been appointed sales manager of Anaconda Wire & Cable Co. In the newly created position he will act as assistant to L. R. Love, general sales manager.

DAVID E. ALLEN

Following his graduation from Annapolis in 1922 Allen worked as an electrical engineer with public utilities. He joined Anaconda in 1932 and has held engineering and sales posts with that company ever since, except for four years in the Navy.

•

Promotions, Retirements Are Reported by NEES

Earl P. Moseley has been appointed hydraulic engineer of New England Power Service Co as one of a series of personnel changes being made by New England Electric System.

Alfred W. Smith has been named executive assistant to the executive vice-president of NEES and Albert Leddy manager of Amesbury Electric Light Co. New distribution engineer for the Athol, Gardner, Wachusett, and Winchendon companies, with offices at Leominster, Mass., is Edward W. Hitchcock. George V. Kennedy has been named assistant to the assistant district manager of the utilities centering at Leominster.

Retiring are Harry B. Stearns, lighting sales engineer for NEP Service Co; Guy E. Nickerson, vice-president and general manager of the Amesbury utility; and Harry M. Nelson, hydraulic engineer for the service company. Other recent retirements include Fred

There's always a night shift at the SORG printing plant . . . *just in case* copy comes in at night and proofs must be ready in the morning.

For this regular night shift there's no "overtime" charge . . . SORG SERVICE does *not* penalize a customer who *must* have his printing completed in the shortest possible time.

Every facility for handling financial printing is available in our own building for meeting deadlines with the utmost production accuracy and speed.

The SORG PRINTING CO., Inc.

Financial, Legal, Corporate Printers

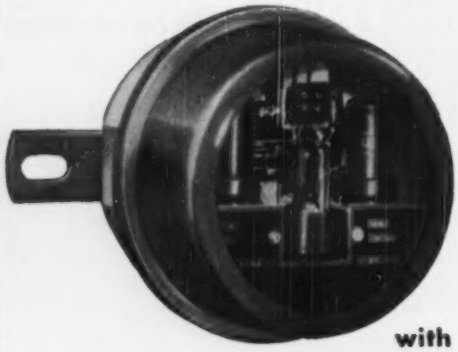
80 SOUTH STREET • NEW YORK 7, N. Y.

SERVICE · QUALITY · RELIABILITY — THE SORG PRINTING CO. IN NY

Chicago Associate
McCORMICK and HENDERSON, Inc.

London Associate
The LEAGRAVE PRESS Ltd.

REDUCE your street light control COSTS



with

FISHER-PIERCE PHOTOELECTRIC CONTROLS

Improved lighting service is available to cities and towns through the use of photoelectric controls by Fisher-Pierce. These units are giving continuous, positive service in hundreds of modern applications . . . regardless of weather, climate or daylight conditions.

Approved by cost-conscious engineers, Fisher-Pierce controls offer a simplified photo-relay for control of multiple or series street lighting systems. F-P economies include long tube life (20,000 hours or more), easy servicing (simple plug-in chassis construction), *no resetting after power interruptions*. In other words, exceptionally *low maintenance costs*. We'd like to give you details on our units for improved street lighting. A request will bring full information promptly.

FP The FISHER-PIERCE COMPANY, INC.

82 CEYLON ST., BOSTON 21, MASSACHUSETTS

N. Monteith, production superintendent of Haverhill Electric Co's Haverhill and Newburyport steam plants; Harold K. Vaughan, chief engineer of Gloucester Electric Co; W. S. Maddocks, power engineer, Narragansett Electric Co; George L. Munroe, rural service engineer of Narragansett; Harold G. Morse, assistant superintendent of production there; and Frank M. Lucas, superintendent of production.

Moseley joined the system in 1921 and was active in construction of the hydro development on the Deerfield River and at Bellows Falls on the Connecticut. Later he was transferred to the Boston headquarters and in 1948 became assistant hydraulic engineer.

Smith joined Lowell Electric Light Corp in 1925 as a student engineer and has been engaged in financial work with system companies during most of his career, most recently as assistant treasurer for the central district companies at Worcester. Leddy, who entered system service in 1920, specialized in sales work at Providence, Attleboro, and Haverhill. Recently he has been merchandising assistant for the service company.

Stearns did test work for General Electric Co at Schenectady before joining the New England System, with which he has been in power sales for many years. Nickerson joined Amesbury in 1904 and became manager in 1927. Nelson had been hydraulic engineer of the service company since 1932. Monteith, who joined Haverhill Electric in 1913, had been chief engineer since 1920.

•

Ganson Purcell Heads Security Board of AEC

Ganson Purcell, Washington, D. C., attorney and former chairman of the Securities and Exchange Commission, has been appointed chairman of the Atomic Energy Commission's personnel security review board. He succeeds Judge Charles Fahy, who resigned to accept appointment to the U. S. Court of Appeals for the District of Columbia.

The Board reviews individual security clearance cases and advises on procedures.

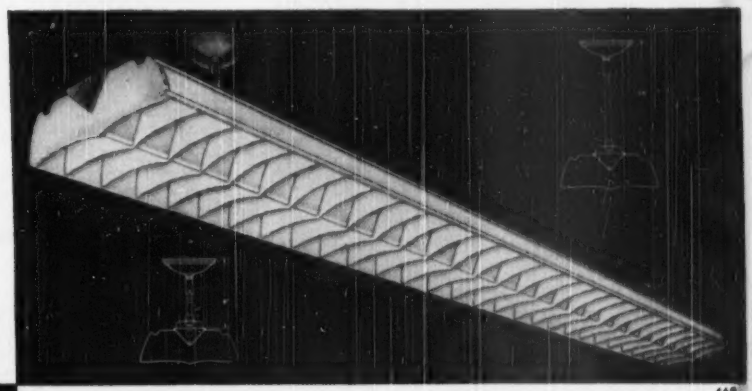
Purcell will continue as a partner in the New York and Washington law firm of Root, Ballantine, Harlan, Bushby & Palmer. A native of San Gabriel, Calif., he joined SEC's legal staff in 1934, was appointed to the Commission in 1941, and served as chairman from 1942 to 1946. He also was a member of the President's National Power Policy Committee from 1942 to 1946.

Other members of the AEC Security Board are Pres Arthur S. Flemming of Ohio Wesleyan University and Bruce D.

NOW!

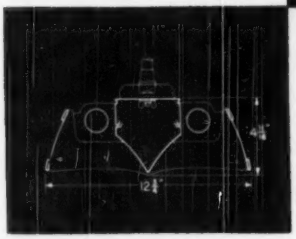
DAY-BRITE'S LUVEX

NEW!



469

For two 96" T-12 Slimline lamps, single unit or continuous installations. For suspension mounting, listed with 8" and 28" "A-J" Adjustable hangers.



"DECIDEDLY BETTER" SLIMLINE

Once in a blue moon, a truly great fixture makes its appearance. Now, after years of research and designing, the matchless new Day-Brite "LUVEX" is ready.

All the usual advantages of Slimline, of course — instant starting . . . extremely high efficiency.

But then, add these "LUVEX" extras—sturdy, *no-sag*, heavy gauge steel chassis, *enclosure and louvers completely interlocked into a rigid one-piece unit*, quick, easy installation and smart appearance—and the "LUVEX" is absolutely *everything* you expect of Slimline lighting.

Maintenance? *Simple!* So simple, in fact, that the "LUVEX" can be relamped and cleaned without disturbing a single part of the fixture—without so much as touching a latch, chain, nut or bolt!

Get the full "LUVEX" story. It will pay you to know all the facts about this remarkable new Day-Brite development. Write today for Bulletin 10-M.

IT'S EASY TO SEE WHEN IT'S
DAY-BRITE Lighting

Distributed nationally by leading electrical wholesalers
Day-Brite Lighting, Inc., 5423 Bulwer Ave., St. Louis 7, Mo.
In Canada: Amalgamated Elec. Corp., Ltd., Toronto 6, Ontario

RIGHT for the JOB . . . RIGHT ON THE JOB!

PINCO'S NEW
L4038 Clamp
(Accommodates .16" to .375"
Conductors Inclusive)

Improved Keeper Design Increases Clamping Area . . . Minimizes Possibility of Damage to Conductor.

For the past ten years, men who "know" clamps have maintained that the PINCO L 4038 was "tops" in its class. And they were right, because here was the *first* dead-end clamp that had no loose parts in conductor assembly . . . replacing a design that had eight! It also showed improved vibration characteristics with small copperweld or stranded copper conductors. Now this clamp has been made even more efficient because an *extra long* J-Bolt Keeper *doubles* the gripping area on the conductor (contacts *all* wires in the long-lay conductors) . . . holds them securely yet without damage to conductor wires.

So here again is another typical example of Pinco planning which pays off in improved product performance . . . making the Pinco phrase —"RIGHT *for* the Job—RIGHT *on* the Job" one to remember whenever you specify and buy insulators and line hardware.

The Porcelain Insulator Corporation
761 Main Street, Lima, N. Y.

Sales Agents: JOSLYN MFG. & SUPPLY CO.
Offices in Principal Cities

PINCO INSULATORS

Suspension Insulators . . . Switch and Bus Insulators . . . Distribution Clamps . . . Distribution Pin Types and Guy Strains . . . Transmission Line Fittings . . . Tree Insulators . . . Transformer and Circuit Breaker Bushings . . . One Piece and Multi-part High Voltage Pin Types . . . Suspension and Strain Clamps . . . Indoor Bus Support Porcelain . . . Lightning Arrester Porcelain.

• 1920 Thirty Years Service to the Electrical Industry 1950 •

Smith, a director of the United Corporation, New York.

•

James V. MacDonald, publicity director of Boston Edison Co, has been appointed manager of the utility's advertising and promotion department. He joined the company in 1923. **John J. Barry** has been named assistant manager of the same department to direct a division on publicity and public relations. **James A. Galvin** has been named superintendent of the public relations department, supervising claims, adjustments, and district management. **Timothy J. Regan** is the new assistant superintendent of the public relations department, with direct supervision over district managers.

Frank M. Ogles, manager of employee and community relations for Trumbull Electric Co, Plainville, Conn., has been elected vice-president in charge of employee and community relations. **Taylor D. MacLafferty**, manager of marketing, has been promoted to vice-president in charge of marketing.

OBITUARY

Wesley M. Giles

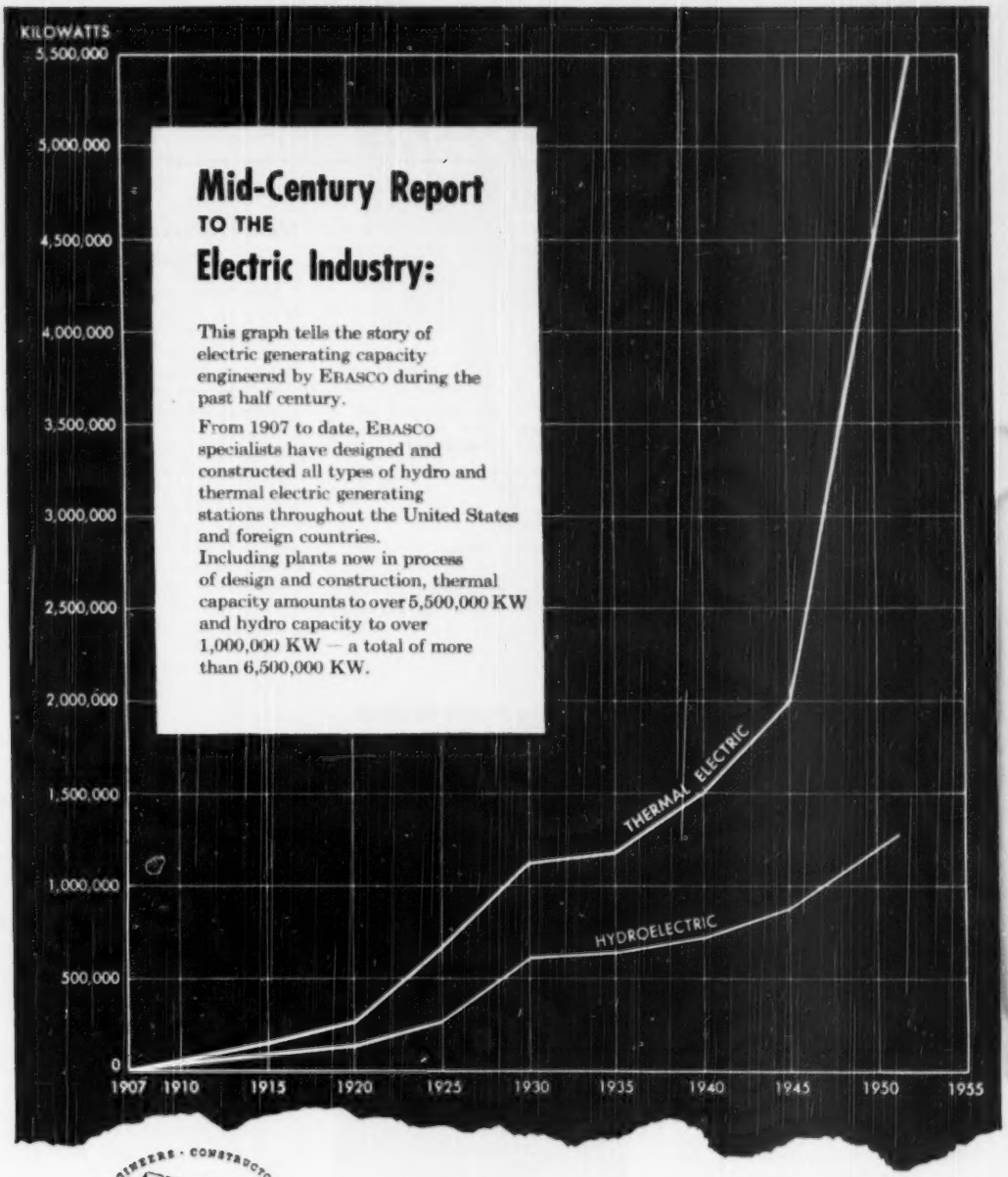
Wesley M. Giles, 59, regional finance head for the Rural Electrification Administration's Region Three, died Jan 19 shortly after suffering a heart attack in his office in Washington.

Giles, who had been with REA since 1937, was in charge of its financing in Kentucky, Tennessee, Mississippi, and Alabama. An electrical engineer, he had been employed by utilities in New York and Mansfield, O. Giles entered government service in 1933 and was with the Federal Emergency Relief Administration and the Treasury Department before going to REA.

•

Emil A. Ekern, 68, active in hydro and electrical engineering with Boston consultants, died at Cambridge, Mass., Jan. 3. He had worked for Stone & Webster Engineering Corp and Charles T. Main, Inc, and had been an associate with Vaughan Engineers, Boston. During the war he was in charge of electrical engineering projects at Camp Edwards, Mass., and later investigated Puerto Rican hydro resources. At the time of his death he was on the staff of Fay, Spofford & Thorndike, Boston engineers.

James F. Dubois, 83, Georgetown, Mass., retired superintendent of Lynn Gas & Electric Co, died Jan 11 at Haverhill.



Mid-Century Report
TO THE
Electric Industry:

This graph tells the story of electric generating capacity engineered by EBASCO during the past half century.

From 1907 to date, EBASCO specialists have designed and constructed all types of hydro and thermal electric generating stations throughout the United States and foreign countries. Including plants now in process of design and construction, thermal capacity amounts to over 5,500,000 KW and hydro capacity to over 1,000,000 KW — a total of more than 6,500,000 KW.

ENGINEERS · CONSTRUCTORS · BUSINESS CONSULTANTS

EBASCO

Write for the booklet "*The Inside Story of Outside Help*" describing the many EBASCO services available to you. Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

Appraisal	Design & Construction	Insurance & Pensions	Sales & Marketing
Budget	Financial	Purchasing	Systems & Methods
Business Studies	Industrial Relations	Rates & Pricing	Taxes
Consulting Engineering	Inspection & Expediting	Research	Traffic

EBASCO SERVICES

INCORPORATED

NEW YORK · CHICAGO · WASHINGTON, D. C.

Ebasco Teamwork gets things done anywhere in the world

MANUFACTURERS and MARKETS

Union Elections Planned in GE Plants Next Month

The first big election in the jurisdictional fight between the two electrical unions will be held in approximately 100 General Electric Co plants around Feb 10. The elections will be plant by plant, not company-wide.

GE has been accused by each of the two unions—the new CIO International Union Electrical, Radio & Machine Workers and the United Electrical, Radio & Machine Workers (ex-CIO)—of favoring the other. This is because the company continued the check-off of UE employees who signed new authorizations (over IUE-CIO protests) and cancelled its contract with UE as of Apr 1 (over UE protests).

GE denied showing any partiality, insisted it is being strictly neutral in the interunion fight.

MANUFACTURING BRIEFS

Heinemann Electric Co, Trenton, N. J., has formed a South African subsidiary to be known as Heinemann Electric (SA) Ltd for the manufacture of circuit breakers. The company, whose initial capital of £25,000 probably will be increased to £100,000 later, expects to go into production about the end of October. Its factory will be established in Johannesburg, and the technical staff will be trained by American experts.

Highland Engineering Co, Hicksville, L. I., has been opened by William R. Spittal for manufacture of transformers, inductors, rectifiers, and power supplies for the industrial and electronic fields. Spittal's production manager in the new organization is Charles W. Cutney. The firm provides cased or uncased units in capacities from 5 va to 50 kva.

Ohio Electric Manufacturing Co, Cleveland, has purchased all assets except the plant of the Wright Hoist Division of Lisbon Hoist & Crane Co, Lisbon, O., and also has bought the nail-making machine business of Black Industries, Inc, Cleveland. The "Bob-Cat" hoist, which ranges from 5 to ½ tons in capacity, is of the electric motor type and provides a further outlet for Ohio's electric motor division.

Westinghouse Electric Corp will increase its production of television receivers by 75% this year, according to Lawrence K. Doylin, Jr, radio and television manager of the company's California district. He predicted the industry would make more than 3.5 million receivers in 1950 and that more than 24 million families would be within range of the 98 stations to be in operation at the end of this year.

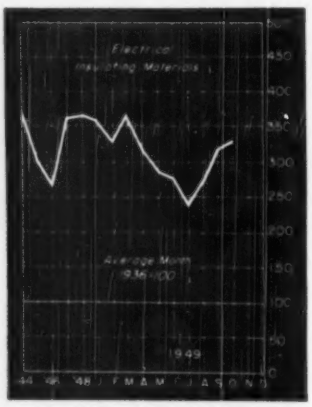
General Electric Co has purchased a 104,000-sq ft tract in Emeryville, Calif., for erection of a warehouse to expand the facilities of General Electric Supply Corp in the East Bay area.

•

Insulating Material Sales Rose Slightly in October

Insulating material sales rose in October but less sharply than in the previous month.

The index of sales billed on electrical insulating materials, compiled by the National Electrical Manufacturers Association, was 330 in October, 4% above September's 318. September had been 16% over August. October sales were 15% below the same period of 1948, when the index stood at 390.



New Process Successful in Synthesizing Mica

Mica, a critical material in the manufacture of electrical and electronics equipment, has been successfully synthesized by scientists of the National Bureau of Standards from quartz, magnesite, bauxite, and a fluorosilicate compound which serves as a crystallizing agent.

The synthetic mica has essentially the same properties as natural mica but is superior to the latter in its ability to withstand high temperatures.

Synthetic production may make it possible for the United States to meet its own demands for mica, used as an insulator in radio equipment and in almost every field of electrical manufacturing. This country is the world's largest consumer of the material but now produces enough to meet only a fraction of its requirements.

•

GE Pittsfield Plant Adds Mercury-Turbine Unit

General Electric Co has completed what is believed to be the country's only industrial installation of a mercury-turbine electric power generating unit. The 7,500-kw unit, which was added to an existing steam station, will increase generating capacity by one half and will add a third to the steam supply used to heat buildings at the company's transformer and allied product divisions plant in Fittsfield, Mass.

Included in the system is a mercury boiler, a mercury-turbine generator, and two condenser boilers. The expanded and remodeled power station now has a normal capacity of 22,500 kw plus an emergency standby capacity of 5,000 kw.

•

New Sales Assignments

Electrical manufacturing companies have made the following appointments to their sales staffs:

Combustion Engineering-Superheater, Inc, New York, has established a new Western division with headquarters in Los Angeles and branch offices in San Francisco and Seattle. Robert M. Hatfield, Jr,

formerly assistant general sales manager, has been appointed general manager of the division, and H. G. Thielscher, formerly West Coast resident engineer, has been appointed chief engineer, with headquarters in San Francisco. Frank Bader of the Philadelphia office has been transferred to San Francisco, and Elmo Keeler has been moved from New York to Los Angeles.

Westinghouse Electric Corp has appointed C. Swan Weber manager of the Eastern district, with headquarters in New York. He formerly was manager of the Newark, N. J., branch office.

Graybar Electric Co, New York, has named F. P. Hoeffler, former acting district operating manager in Minneapolis, district operating manager at Pittsburgh. He will direct warehousing, office, and inside sales activities in the Pittsburgh and Youngstown offices.

Allis-Chalmers Manufacturing Co, Milwaukee, Wis., has made a number of changes in general machinery district office personnel. A. B. Frost, formerly manager of the New Haven district office, has been named Boston manager. W. F. Taylor, former manager of the Boston office, now will devote all his time to his duties as regional manager. J. E. Smet, formerly representative in the Boston office, is now manager of the New Haven office, and H. C. Sells, formerly a representative in the Knoxville office, is the new manager of that office, now a branch of Chattanooga. G. H. Hoffman, former Knoxville manager, will succeed retiring J. J. Greagan at Birmingham. Greagan will stay in the Birmingham office as a special representative. G. G. Fintak will assist sales representatives of the New England region in Boston with hydraulic turbine and pump applications.

Rome (N. Y.) Cable Corp has named Anton M. Mitrovich, formerly with General Electric Supply Co, as its representative in the Portland, Ore., area.

Westinghouse Electric Corp, Lamp Division, Chicago, has appointed Ralph R. Cheney manager of a newly created Milwaukee lamp sales division.

Lighting Products, Inc, Highland Park, Ill., has made the following new territory assignments: Lon E. Russell, 806 Chamber of Commerce Building, Miami 36, to cover Florida; Glenn Arnold, 2378 Beecher Road SW, Atlanta, Georgia, and Alabama; William Bracken, 3524 Knollcrest, Los Angeles 43, southern California; George Eberhardt, 269 Oak St, Buffalo 3, Buffalo and western New York; and Electrical Sales Co, 2413 Pine St, New Orleans 18, Louisiana, Mississippi, and Arkansas.

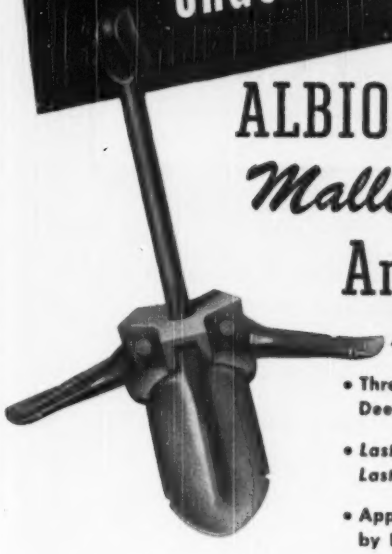
Webster Electric Co, Racine, Wis., has made J. J. Clancy, 3611 Webster St, Fort Wayne, Ind., representative of its sound division in northeastern Indiana and southern Michigan.

Allen-Bradley Co, Milwaukee, has named James A. Setchell San Diego representative. Setchell will operate under his own name at 301 West G St, San Diego 1. He will represent all Allen-Bradley products in San Diego and Imperial Counties in California and in Arizona.

Minneapolis-Honeywell Regulator Co and its Brown Instruments Division have moved their St. Louis branch into a new office building at 4354 Olive St.

For

DEPENDABLE GUYING under All Conditions



ALBION-DILLON *Malleable Iron* Anchors

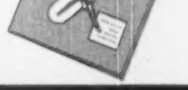
with these Features

- Three Long Blades Extend Deeply in Solid Earth
- *Lasting* Strength Gives Them *Lasting* Holding Power
- Approved by R.E.A.—Selected by Leading Companies
- Economical in Price — Easy, Economical to Install

There are good reasons why more and more companies are now specifying Albion-Dillon Anchors. Made of high-strength malleable iron for long-lasting strength, A-D Anchors prove outstanding for dependable guying under all conditions.

Three sizes—3″, 4″ and 6″, with two variations of blade spread in the 6″ size—are available.

Send for full details today!



Send for Folder!

Descriptive folder gives full details and specifications on A-D Anchors.

ALBION MALLEABLE IRON CO.
One of America's Foremost Producers of Malleable Iron
ALBION, MICHIGAN

FINANCING

★

Electric companies must raise $2,750,000,000 in new money during 1950 and 1951, according to EEI figures.

Is new money the problem of the year for *your* company?

★

We Can Help You:

Study your requirements.
Determine type of securities.
Obtain regulatory clearance.
Prepare registration statement.
In negotiations or awards.
Distribute stocks.
Deliver Bonds.
In the many other details involved.

★

PIONEERS IN SERVICE ENGINEERING PS&E

Pioneer Service & Engineering Co.

231 South LaSalle Street • Chicago 4, Illinois

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arkansas—U. S. Eng., 300 Broadway, Lottle Rock, furnish generator leads, potential transformer, surge protective equip., main generator, breaker equip., neutral breakers, f.o.b. cars Cotter, for Bull Shoals Dam, CIVENG-03-050-50-59.

Calif., San Fernando—Veterans Admin., Vermont Ave. between H and I Sts., N.W., Wash. 5, D. C., rehabilitation electrical distr. sys., incl. monolithic rein.-con. Switch House 54, transformer room in Recreation Bldg. 7, etc., Proj. 12-4228, Spec. 5013, for Veterans Administration Hospital.

Illinois—U. S. Eng., 826 U. S. Court House and Custom House, 1114 Market St., St. Louis 1, Mo., constr. Alton Pumping Station and Gravity drainage structure with electrically driven pump units and adjacent levee sections and other appurtenances, Proj. Item II-C of Wood River Drainage and Levee Dist., Madison Co.

Minn., Austin—City, Water & Light Bd., c/o Secy., furnishing, installing boiler, 150,000 lb. steam per hr., in municipal power plant, $450,000, Helmick, Edeskuty, & Lutz, 412 Essex Bldg., Minneapolis, consult. engrs.

Minn., Rochester—State Dpt. Admin., P. T. Petersen, dir. Purchases, 1 State Capitol, 1 story, bsmnt. power plant and service facilities. Approx. $250,000. Plans deposit $30. Ellerbr & Co., E. 505 First National Bank Bldg., St. Paul, archts.

North Dakota—James Valley Electric Co-operative, Edgeley, rural distr. lines, La Moure Co. **$1,075,000.** Scott Eng. Co., Watertown, S. D., engr.

N. Y., Brooklyn—Bd. Transportation, 250 Hudson St., New York, Zone 13, furnishing, installing D. C. connections and associated work for the Livonia, Nostrand and 239 St. Substations, IRT Div. and Sheepshead Substation, BMT Div. Brooklyn and Bronx.

O., Portsmouth—Detroit Steel Corp., 1025 S. Oakwood St., Detroit, Mich., new continuous hot rolled strip mill and new electric weld pipe mill at Portsmouth Steel Corp. **$10,000,000.**

Oregon—U. S. Eng., 19 E. Poplar St., Walla Walla, Wash., four 73,684 kva. alternating-current generators for McNary Dam powerhouse, CIVENG-45-164-50-80.

Texas—Central Power & Light Co., 120 N. Chaparral St., Corpus Christi, electric power 12,000 volt transmission lines, vicinity Elsa, Edcouch, LaBlanca, LaVilla and San Carlos, **$240,000**; 14 mi. 60,000 volt transmission lines vicinity of Mission, **$90,000**; 16 mi. 60,000 volt transmission line between Mission-Rio Grande City, **$115,000.** C. P. Lear, c/o owner, engr.

Texas—Central Power & Light Co., 120 N. Chaparral St., Corpus Christi, 7 mi. 12,000 volt electric transmision line between North Pharr and Edinburg, **$50,000**; 12,000 volt electric transmission lines across Arroyo Colorado to Rio Hondo, **$50,000**; 25 mi. 12,000 volt electric transmission line between Raymondville and Port Mansfield at Redfish Bay, **$150,000.** A. B. Weaver, c/o owner, engr.

Tex., Hearne—City, electric light plant bldg. remodeling, **$110,000.** Garrett Eng. Co., 5008 Almeda Rd., Houston, engr.

Tex., San Antonio—City Public Service Bd., 201 N. St. Marys St., transformer station, **$150,000**; electric lines into outlying newly-developed areas, **$100,000**; rehabilitation electric lighting sys., underground and overhead lines, **$250,000**; gas booster station units, **$125,000**; gas line rehabilitation at required areas throughout city, **$175,000**; new gas lines into outlying new-developed areas, **$200,000.**

Washington—Bureau Reclamation, Dpt. Interior, Coulee Dam, second-stage concrete for station service unit LS-3, concrete footings and foundations for towers for station service bus ties; altering left powerhouse transformer deck, Grand Coulee Power Plant, Columbia Basin Proj., Spec. R1-CB-42 (Region 1). L. N. Mc-

Clellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Washington—Klickitat County Public Utility Dist. No. 1, Goldendale, 211 mi. rural distr. lines, Sect. E-2, Klickitat and Skamania Counties. H. Zenier & Assoc., Vancouver, engrs.

Low Bidders & Contracts Awarded

Minn., Elk River—Rural Co-operative Power Assn., Maple Lake, Jan. 5, furnishing, erecting piping, valves, fittings, and miscellaneous related equip. in power generating plant under constr., near here, from Tyner Engr. Co., Mitchell, S. D., **$485,000.**

New Mexico—Continental Divide Electric Co-operative, Inc., Grants, Jan. 12, 193 mi. rural distr. lines, McKinley Co., from H. B. Zachry Constr. Co., Box 25 O, San Antonio, Tex. **$302,954.** Est. $173,000.

O., Oberlin—City, City Hall, Jan. 6, municipal light plant adn., S. Main St., from Fairbanks Morse & Co., 2810 Superior Ave., Cleveland, **$74,750.** Est. $350,000. Ralph C. Spangler, 4614 Prospect St., Cleveland, engr.

Texas—Wise Electric Co-operative, Decatur, 239 mi. rural distr. lines, Wise Co., to Irby Constr. Co., 515 S. State St., Jackson, Miss. **$296,341.** Est. $210,000.

Tex., San Antonio—City Pub. Service Bd., 201 N. St. Marys St., Unit 7, addnl. street lighting sys., force account. Approx. **$150,000.**

Wis., Beloit—Fairbanks, Morse & Co., Beloit, power plant, to Stone & Webster Engr. Corp., 33 S. Clark St., Chicago, Ill., **$7,500,000.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., San Francisco—General Services Admin., Public Bldgs. Service, Wash., D.C., extension, remodeling 4 story, bsmnt., rein.-con. brick, terra cotta United States Marine Hospital, rein.-con. boiler house, stack and tunnels, steel stud and plaster partitions, steel furring and plaster, all earthquake constr., Proj. No. 4-113 SA-AE, $3,560,000.

Minn., St. Paul—Minnesota Mining & Mfg. Co., 900 Fauquier Ave., plans by Ellerbe & Co., E. 505 First National Bank Bldg., 5 story, bsmnt. office bldg. **$3,000,000.**

New York—Bd. Educ., 110 Livingston St., Brooklyn, Zone 2, P. S. 112, vicinity 14 Ave. and 24 St., **$1,750,000;** P. S. 194, 163 St. and 21 Ave. E-686, **$1,525,000;** P. S. 188, Kingsbury and Hartland Aves., E-690, **$1,350,000;** P. S. 196, vicinity 72 Ave. and 112 St. E-715, **$350,000;** P. S. 186, vicinity Little Neck Parkway and 72 Ave., E-688, **$1,655,000,** Queens Boro. To go ahead in 1950.

O., Cleveland—Ford Motor Co., 3000 Schaefer St., Dearborn, Mich., 17-acre foundry and engine-assembly plant, covering 200 acres of land between Brookpark and Hummel Rds. **$80,000,000.**

Tex., Dallas—Franklin Stores Corp., 1610 Elm St., mercantile. Approx. **$1,000,000.**

Wash., Everett—Soundview Pulp Co., Everett, recovery plant, **$6,000,000.**

Wash., Everett—Weyerhaeuser Timber Co., Tacoma Bldg., Tacoma, recovery plant, **$4,000,000.**

Wash., Camas—Crown-Zellerbach Corp., Camas, recovery plant, **$6,000,000.**

Low Bidders & Contracts Awarded

Idaho, Lewiston—Potlatch Forests, Inc., Lewiston, pulp paper plant, to W. J. Park & Sons, Yakima. Approx. **$2,000,000.**

Ill., Chicago—Barry-Briar Corp., c/o J. J. Mack, 505 N. Michigan St., 14 story, brick, rein.-con. apartment 3101 N. Sheridan Rd., to Sherry Richards Co., 201 N. Wells St. Approx. **$2,700,000.** Shaw, Metz & Dolio, 208 S. LaSalle St., archts.

N. M., Albuquerque—U. S. Eng., Box 1538, Jan. 10, A-19, laboratory, Sandia Base, Serial No. 251-50-24, from J. W. Bateson Constr. Co., 1102 Irwin-Keasler Bldg., Dallas, Tex., **$2,056,800.**

N. Y., New York—New York University, Washington Square, hospital and medical center, 31 to 33 Sts., First Ave. to Franklin D. Roosevelt Dr., to John Lowry, Inc., 52 Vanderbilt Ave., Zone 17. Approx. **$33,000,000.**

IT MEANS MORE

when BARTLETT is on your LINE CLEARANCE job!

IT means having a nationally-known company on the job . . . a company whose ability and experience people respect and have confidence in. Bartlett men gain your customers' good will; they assure good work and good public relations . . . double protection for you. Bartlett is tops in equipment, in knowledge, in trained man-power. You can't ask for more.

MORE and more utility companies retain Bartlett for line clearance; you can see why for yourself just by calling our local office in your community, or write direct for a representative to call.

BARTLETT SERVICE MEANS

- TRAINED MEN
- BEST EQUIPMENT
- CAREFUL WORK
- PROMPT SERVICE
- ECONOMY
- RESPONSIBILITY

BARTLETT
TREE EXPERTS

The Bartlett Way

HOME OFFICE: RESEARCH LABORATORIES & EXPERIMENTAL GROUNDS, STAMFORD, CONN.

LOCAL OFFICES: Rutland, Windsor, Vt.; Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Manchester, Osterville, Pittsfield, Mass.; Providence, R. I.; Danbury, Hartford, New Canaan, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Peekskill, Southampton, Syracuse, Westbury, White Plains, N. Y.; Somerdsville, Morristown, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Portsmouth, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Bluefield, Charleston, Huntington, W. Va.; Kingsport, Tenn.)

Just Published!

THE PROTECTION OF TRANSMISSION SYSTEMS AGAINST LIGHTNING

By WALTER W. LEWIS

● This is the first time all the important information on lightning has been compressed into a single book for the engineer in the power field. The author has applied this information in a practical way to the design and protection of transmission lines. He discusses all significant tests and experiments which have been made since 1924, and describes the instruments which were used in them.

Basic Information plus Practical Methods

● The first five chapters give basic information on lightning waves. The rest of the book contains practical rules to guide plant owners, designers, constructors, and operators. Rules are given for the proper coordination of line insulation and spacing of conduits for the most effective arrangement of overhead ground wires, and for grounding lines and stations. Thorough coverage is given to alternative methods of protecting transmission lines (both low voltage and high voltage, stations and rotating machines).

January 1950
418 pages
$8.00

EXAMINE BOOK FOR 10 DAYS

ON APPROVAL COUPON

JOHN WILEY & SONS, INC.

440 Fourth Ave., New York 16, N. Y.

Please send me, on 10 days' approval, a copy of Lewis' THE PROTECTION OF TRANSMISSION SYSTEMS AGAINST LIGHTNING. If I decide to keep the book I will remit $8.00 plus postage; otherwise I will return the book postpaid.

Name .....

Address .....

City ..... Zone ..... State .....

(Offer not valid outside U. S.) EW-1-30

CATALOGS • BULLETINS

● ALARM SILENCER: Bulletin 7400 illustrates and describes Autocon Model ABS alarm silencer for use with electrical circuits indicating emergency conditions, as pressure, liquid level, temperature, smoke. Automatic Control Co, 1005 University Ave, St. Paul, Minn.

● SLOT INSULATORS: Proper selection material for slot insulators, together with styles in which material is available, are given in an 8-page bulletin. Insulation Manufacturers Corp, 565 W. Washington Blvd, Chicago 6, Ill.

● CONTROLS: Illustrated and described in the merchandising catalog are safety switches, service control and multi-breakers, motor control, and other related equipment. Cutler-Hammer, Inc, Milwaukee, Wis.

● MOTORS: Information on Type 350 shaded pole induction motors from 1/6 to 1/40 hp and Type 230 in ratings from 1/50 to 1/200 hp appears in Bulletin 2000 and 1000, respectively. Russel Electric Co, 4501 S. Western Blvd, Chicago 9, Ill.

● RELAYS: Catalog D-20A lists stock-type industrial and general-purpose relays. Ward Leonard Electric Co, Electronic Distributor Div, 53 W. Jackson Blvd, Chicago 4, Ill.

● LIGHTING: Information on modular lighting together with descriptions of the basic parts of the unit are presented in a 20-page booklet. Mitchell Manufacturing Co, Chicago 14, Ill.

● DIESEL ENGINES: "Public Utilities" is an illustrated booklet describing the varied applications of equipment and engines in the field of public service, and emphasizing the use of Diesel power in laying power lines, stringing wire, or handling coal. Caterpillar Tractor Co, Peoria 8, Ill.

● TERMINATORS: Three-conductor terminators for indoor and outdoor service, 2.5 to 23 kv, 1/0 to 1,000 Mcm cable, are described in Publication 4111-A. Delta-Star Electric Co, 2400 Block Fulton St, Chicago 12, Ill.

● PYROMETER: Catalog Section 25 contains information about the multiple point pyrometer indicator. Thermo Electric Co, Fair Lawn, N. J.

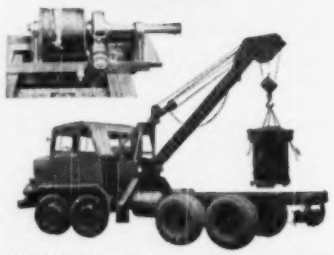
● GENERATORS: Points to look for when ordering large a-c generators are covered in non-technical language in "Your Guide to Profitable Installations of Modern Generators" Bulletin 2200-PRD-196. Electric Machinery Mfg Co, Minneapolis 13, Minn.

● TAPE: Construction details and specifications for Scotch brand electrical tape No. 27 are given in a four-page brochure. Minnesota Mining and Mfg Co, 900 Fauquier St, St. Paul 6, Minn.

● HEATING EQUIPMENT: In Catalog 50 are descriptions of industrial electric heaters. Domestic electric heating equipment including unit heaters, electric stoves and water heater units appear in Catalog D-49. Edwin L. Wiegand Co, 7513 Thomas Blvd, Pittsburgh 8, Pa.

Utilities Have Specified SILENT HOIST Equipment • Since 1918 •

KRANE KAR Swing Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.



WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck; Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or rocking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:
No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT WHEEL DRIVE AND REAR WHEEL STEER
½, 1, 2½, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
867 63rd ST., BROOKLYN 20, NEW YORK

TECHNICAL LITERATURE

Turbines—Statements by operating companies and manufacturers are contained in *Turbines, Condensers and Auxiliaries, Feedwater Heaters and Evaporators, 1946-47*. This report by the EEI Subcommittee on Turbines and Condensers also contains sections on turbine operating and outage data, and simultaneous unscheduled outages of major plant equipment. Publication R-3 is available to members for $1.40 from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

Network Operations—Data submitted by 80 companies on operations of 272 networks in 168 localities were compiled and compared with prior data wherever possible in *A-C Network Operations, 1944-46*. Load growth data and other system characteristics are presented in some detail as well as information and tables on network protectors and relays, network transformers, secondary cable systems and failure data, and network outages, maintenance and inspections. The Transmission and Distribution Committee of EEI has prepared the report, No. Q-12, priced at 60¢ to members. It is published by Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

Tube Data—The seventh edition of the *Receiving Tube Data Book* contains basic application data for cathode ray tubes and 637 radio receiving tube types. The 418-page manual is priced at 85¢ per copy, and can be obtained from Sylvania Electric Products Inc, Radio Div, Emporium, Pa.

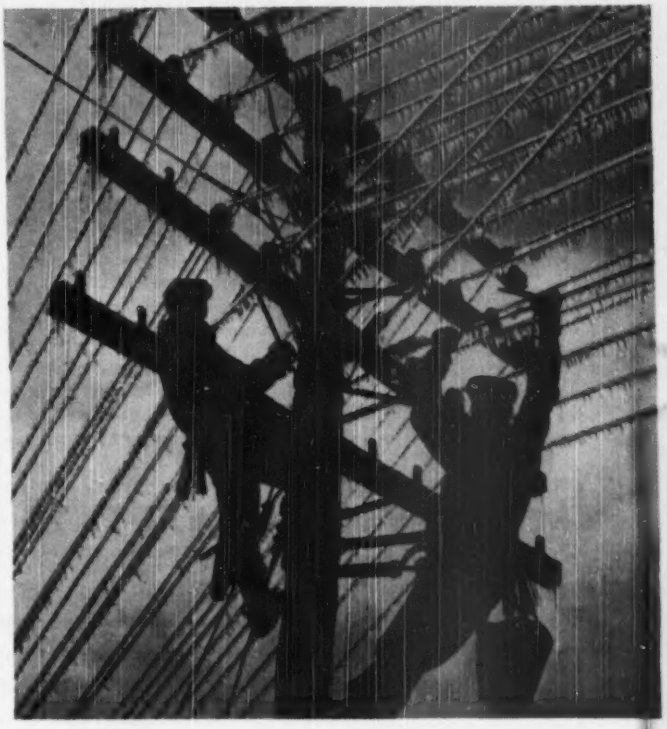
Specifications—*1949 Electrical Specifications* is a manual of specification procedure with master specification for electrical construction and installation. Topics covered are: Service entrances; grounding; transformers; switches and panels; feeders; branch circuits; signal, communication and auxiliary systems; lighting; motors and controls. Twenty-eight tables also appear with these specifications which are priced at $1 and reprinted from the July 1949 issue of "Electrical Construction and Maintenance". Copies can be obtained from the McGraw-Hill Publishing Co. 330 W. 42nd St, New York 18, N. Y.

Metal Paint—*Dutch Boy Metal Painting Handbook* contains material on the theory of corrosion, function of red lead, surface preparation, and application of metal paints. Also included is a table of properties of various paints, intended uses, and general description of typical paints. The handbook is published by the National Lead Co, 111 Broadway, New York 6, N. Y.

Electrical Units—A description of the new system of electrical measurement using "absolute" units, adopted by the International Conference of Weights and Measures and officially instituted January 1, 1948, is described in *Establishment and Maintenance of the Electrical Units*. The booklet records the official steps by which the international units maintained for 37 years were superseded and describes the methods of measurement that form the new units. Circular C 475, with 22 illustrations and tables, can be obtained for 25¢ from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Electrical Raceways—A reference source on rigid steel conduit and electrical metallic tubing is provided in *Steel Electrical Raceways*. Basic dimensional data and the necessary NE code tables that pertain to conduit wiring installations are included in the 131-page book. Distribution is being made through manufacturers of rigid steel conduit and EMT and, at $1 per single copy and reduced cost in quantity, by the American Iron and Steel Institute, 350 Fifth Ave, New York 17, N. Y.

A Dangerous Job Made Safer



WITH KOPPERS PRESSURE-CREOSOTED POLES!

WORKING on lines that are crusted with ice—that's no picnic for linemen. And they don't want the additional hazard of working on poles that have been weakened by shell rot.

Koppers Poles are pressure-creosoted against decay for their full length. They *stay* sound and strong. Besides being safer for linemen, these strength-retaining poles last longer—in fact, the average life is better than thirty years.

For safer poles—for longer-lasting poles—specify Koppers. Deliveries of Koppers Full-Length Pressure-Creosoted Poles are made promptly from many conveniently-located treating plants.

KOPPERS

KOPPERS COMPANY, INC., Pittsburgh 19, Pa.

PRESSURE-CREOSOTED WOOD

EILAR TREE EXPERTS

An Organization of Specialists

EQUIPPED AND READY TO SERVE UTILITIES EVERYWHERE IN

LINE CLEARING

TRIMMING .. TOPPING .. TAKEDOWNS

• Our regular utility customers tell us that we consistently do better tree work, maintain better public relations AND AT FAR LOWER COST, than their own company crews have in the past.

WE know that this type of work requires very strict attention to PUBLIC RELATIONS and we proceed accordingly, observing every detail in this regard.

We would like to submit our complete story to you so that you can see how we are organized to do an expert job and how we cooperate fully with you and your community.

EILAR TREE EXPERTS

Telephone Lynchburg 7787

P. O. BOX 1039 HOUSTON 1, TEXAS

SUPERIOR • SUPERIOR • SUPERIOR • SUPERIOR • SUPERIOR

You just can't beat

SUPERIOR

Meter Testing and Installation Equipment

for quality and long-lasting economy

Test Blocks • Test Switches • Special Switches • Test Tables • Safety Blocks • Meter Enclosures • Meter Connection Units • Reactiformers • Transformer Enclosures • Accessories

SUPERIOR SWITCHBOARD & DEVICES CO.

CANTON, OHIO

A subsidiary of The Union Metal Manufacturing Company

BOOK REVIEWS

Acoustic Measurements. By L. L. Beranek. Published by John Wiley & Sons, Inc, New York 16. 914 pages, illustrated. Price $7.

Transformer hums, turbogenerator whines and semi-siren whistles from fan blades emitted by stacks are just a sample of the sounds which electric utility system engineers may need to measure quantitatively. They impinge upon the public and control may prove necessary. Anyone confronted with such amelioration will find here the intricate physics and methodology which typifies the efforts to measure sound despite the array of variables and obstacles characterizing the art. These difficulties explain why the chapter on the sound level meter is the shortest of the twenty which comprise the book. Among them are the ear, microphones, the audiometer, random noise, sound-wave analysis, loudspeakers, acoustics of rooms and of materials. The author is on the MIT staff and the project was subsidized by Naval Research.

Electronics: Experimental Techniques. By W. C. Elmore and M. L. Sands. Published by McGraw-Hill Book Co, Inc, New York 18. 417 pages, illustrated. Price $3.75.

This book deserves a more significant title lest it be construed as a manual for laboratory experiments in the electronics class. On the contrary it is a highly practical exposition for the scientific or industrial researcher who wants to choose and apply effectively the most appropriate circuit assembly. The authors take pains to discuss the pertinent details which underlay all the radiation instrumentation at the Los Alamos Scientific Laboratory. They set down for their inevitable-turnover successors the staff reasoning which resulted in a wide range of circuits. Better yet they started there and in the book with a discussion of the circuit components and then encompassed these in circuit elements before assembling the latter in the more or less complicated arrays which they needed for their greatly accelerated program. They knew how and this is the know-how.

Rewinding Small Motors. By D. H. Braymer and A. C. Roe. Published by McGraw-Hill Book Co, Inc, New York 18. 422 pages, illustrated. Price $4.50.

This third edition was prepared by Roe to incorporate the advances in the art which have been achieved since the previous edition of 25 years ago. New forms of winding conducive to faster production, enameled wire, silicone and glass-tape insulation are just a few of the improvements incorporated in modern motors that find themselves in the repair shop. None of the practical, easy-to-understand directions have been sacrificed and therefore the book is afresh the indispensable at-the-elbow aid of the technician who is called upon to rewind and recondition d-c, a-c and a-c/d-c motors. The small 3-phase motor is included. The photographs and diagrams reflect fine skill in displaying the salient details.

Alternating Current Machinery. By L. V. Bewley. Published by The MacMillan Co, New York, 376 pages, illustrated. Price $5.25.

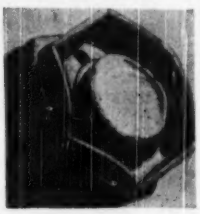
Not just another book on a-c machinery, but a truly modern text. The strength of this work lies in the tidy logic of its gen-

Truscon equips world's tallest radio tower *with*

PALNUT
TRADEMARK

LOCK NUTS

This new 1220-foot Truscon Radio Tower, tallest ground-supported tower ever built, incorporates many advanced engineering specifications. But one important specification remains unchanged . . . the use of PALNUT Lock Nuts . . . continuing a 15-year standardization by the Truscon Steel Company, Youngstown, Ohio for all its towers.



- **Prevents loosening of regular nut and bolt.**
- **Eliminates checking and retightening of bolts.**

FOR years PALNUT Lock Nuts have been standard equipment on towers built for AM, FM, TV, Signal Corps, power transmission, etc. Low in cost, easily applied on top of regular nuts. PALNUTS provide absolute assurance against loosening of bolted assemblies. No further maintenance is required. PALNUTS have proved superior to lockwashers or prick punching.

Specify PALNUTS for your towers. Available in a wide range of sizes, hot dip galvanized for weather resistance. Ask for samples and literature.

The PALNUT Co.
51 CORDIER ST. IRVINGTON 11, N. J.

eralized approach to the analysis of the more important kinds of a-c machines. The author has broken away from some of the wobbly scaffolding of false premises and artificial concepts upon which similar texts have been built for many years. Key features of the generalized method of analysis are: (1) A general equation of voltage recognizing simultaneous movement of conductors, flux displacement and pulsation and which treats as special cases all processes of voltage induction found in any machine. (2) A general equation of armature reaction that applies to any machine —a-c or d-c. Viewed from these general equations one machine differs from another only in the presence or absence of specific terms. The result is a greater unification of concept. As a test for EE juniors and seniors or a refresher for rusty professionals it's an equally good investment.

Electric and Magnetic Fields. By Stephen S. Attwood. Published by John Wiley & Sons, Inc, New York. 475 pages, illustrated. Price $5.50. Third Edition.

This text was originally written to serve as a transitional text linking the study of mathematics, mechanics and physics with advanced field theory, electronics and machine design.

This latest edition has a new introductory chapter on magnetic fields emphasizing current, rather than magnetic poles, as a fundamental source of magnetic effect. Sections on magnetic materials include magnetization curves of a wider range of metals. Other features are: (1) Use of new "field mapping" methods; adoption of mks system of units with formulas recast in nationalized forms from the cgs forms of early editors and (2) An appendix has been added to facilitate transfer of magnitudes between mks and cgs systems.

Direct-Current Armature Windings. By Charles Siskind. Published by McGraw-Hill Book Co. New York 18. 150 pages, illustrated. Price $3.00.

This author's approach to the problem of simplifying the fundamental principles involved in winding modern d-c armatures is to show the student that, although the subject is complex, it is composed of the combination of simple ideas. He uses original simplified formulas for the calculation of the construction details of all types of windings. Novel testing procedures for locating winding trouble are described and problems worked out to show how winding may be changed to obtain different operating characteristics. Similarities and differences of various windings are highlighted by elemental illustrations which bring the subject down to the level of the classroom student and the shop worker.

Facsimile. By Charles R. Jones. Published by Murray Hill Books, New York 16. 422 pages, illustrated. Price $6.00

Historical and modern facsimile equipment are described and the practical uses discussed before taking up the mechanics of the art. At this stage the treatment deals with the transmitter and receiver, as well as the means for synchronizing and phasing. A chapter is devoted to detail description of each of seven different makes of facsimile devices. Final chapters present specific servicing advice for Finch and Hogan (General Electric and Radio Inventions) sets. The author, a Finch engineer, envisions a greatly expanded use of facsimile transmission by business and government. His book will facilitate that expansion.

A touch of zero in the farmer's kitchen

STRAWBERRIES in December! That's just one small pleasure for the farmer who owns a frozen food unit. More important, it preserves fresh meat and farm-grown vegetables and reduces costly marketing trips for food. Refrigeration for the farm . . . gift of electricity!

With the increasing demand for rural electrification, comes the need for efficient pole-line insulation. Hemingray Power Insulators provide the highly efficient and dependable insulation necessary for medium voltage lines.

No. 670 for 12,000-volt lines. The Technical Standards Committee of the Rural Electrification Administration has approved Hemingray Insulators No. 670, No. 680 and No. 514, under the limits of AIEE Specification No. 41-1944 for use on REA lines.

HEMINGRAY
POWER INSULATORS
American Structural Products Company
Muncie, Indiana
Subsidiary of Owens-Illinois Glass Company

NEED A TIGHT SEAL FOR CABLE ENTRANCES, SERVICE BOXES, CONDUIT ENDS?

...then use

Johns-Manville

DUXSEAL

DUXSEAL is the "Handy Andy" of sealing compounds for closing up conduit and duct ends . . . for sealing openings around wires and service boxes . . . for quickly plugging up drill holes in foundations.

Stays plastic—It stays soft indefinitely, can be used in any weather just as it comes from the package.

Stays tight—It adheres to duct walls and cables, but gives with the expansion or contraction of the wire.

Stays insoluble—It is unaffected by ground waters, gases and low heats, will not slump, melt or run.

Stays re-usable—It can be re-used to form a new *tight* seal after years in service.

Tight seals for other electrical uses

J-M TRANOLSEAL . . . for use with electrical equipment using dielectric oils.

J-M UNISEAL . . . for caulking against weather and humidity. Resists temperatures up to 180 F.

For further information on any of the above sealing compounds, write to Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville

SEALING COMPOUNDS

LETTERS TO THE EDITOR

Engineers for Executives

To the Editor of ELECTRICAL WORLD:

The December 3 issue of ELECTRICAL WORLD contained an article entitled *Seminar for Engineering Faculty* which was of a personal interest to the writer. To one who has always been an ardent supporter of the free enterprise system and of private utilities in particular, the action of the Cleveland Electric Illuminating Co is an indication of a forward looking policy and one that the entire industry could do well to investigate. . . .

The experience of the writer began in 1932. An EE graduate and more than 2 years on GE's test course found the undersigned at home employed in the meter department of a midwest private utility. . . .

After 5 years of various assignments including the commercial department, an offer as a substation operator removed the doubt, at least to the writer, as to the future with that company.

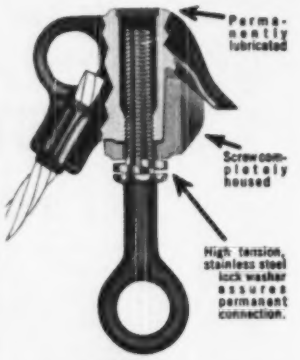
Securing a job with another midwest private utility it was somewhat of a repetition of conditions with this company as the first. After 5 years with this company came an acceptance of a commission in the Signal Corps in radar work. Upon returning to this company in 1945 after 3½ years in the service the job offered had a salary of less than 15% above the salary in 1942. Needless to say the economics of that situation caused employment elsewhere.

A survey showed that those selected by these two companies . . . for managers or minor executives . . . were salesmen, accountants or individuals of public life, all with little or no engineering or practical operating background. A further check will show that quite a number of the utility engineers have secured employment in other forms of industry for various reasons, not the least of which is financial.

It is realized that a majority of the members of the Engineering Profession do not possess the characteristics nor the desire to learn that other part of the managerial or executive job that can be learned best from working at it and in it, but are happier at extending their efforts in the engineering field only. The standard stock reason given by management for the low standards of pay is that the utilities' rates and services are set, controlled and regulated by the many governmental regulatory bodies and as a result cannot market their product according to the laws of supply and demand, this fact, however,

It's here—the NEW Hot Tap Clamp

- Adaptable to all clamp sticks
- Heavier—Larger—Rugged
- Made in 2 sizes—2 styles

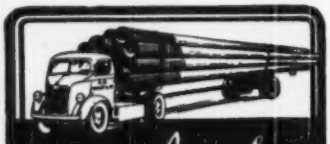

Permanently lubricated
Screw completely housed
High tension, stainless steel lock washer assures permanent connection.

Binkley

Write for sample and new low prices!

Address Dept. EW

MANUFACTURING CO.
WARRENTON, MO.



Haley's

CEDAR POLES
FIR CROSS ARMS

Quick Truck Shipments from our Ohio yard

●

Also yards at Minneapolis and Haley, Idaho

R. G. HALEY & CO., Inc.
SPITZER BLDG.
TOLEDO 4, OHIO

is not backed up by the financial reports which they periodically release to the financial pages of the newspapers to impress the investors but are read also by employees, union officials and the public in general.

In the face of inroads being made by the different governmental public power agencies something must be done and soon by the private utility policy makers to develop high grade trained engineer executives and then to make the job attractive enough to keep them. The plan of the CEI seems to be a good start in that direction.

Jack Sanders
Power Engineer
Independence, Kansas

Losses vs Peak Estimates

To the Editor of ELECTRICAL WORLD:

It's always encouraging to discover that we see eye-to-eye on some of the controversial issues of our business, particularly on some of the interesting matters that you call attention to in your always thought-provoking "Technical Notes". But in the News Issue of October 29th is a comment that doesn't quite click.

You say, "Peak-load estimates 1% too high are *never* likely to modify generating capacity programs but errors of the same amount on the low side are *certain* to accumulate to an insufficiency—".

Never? Certain?

In my recent Midwest Power Conference paper "The Cost of Supplying Electrical Losses" were a couple of tables (Table 2 and Table 3) that at first blush might seem to support your conclusion. But the purpose of those tables was specifically to illustrate that such situations might arise "through pure chance". In fact, it was concluded that "it appears that we can safely admit only that reduced losses may not always serve to defer capacity installations", and suggested introduction of a factor of 50% to evaluate the probability *in either direction.*

Let me give a few examples to show how very slight changes in the peak loads, before the 1% increase or decrease, would change the picture entirely.

First, consider Table 3, which shows that 1% increase in peaks has substantial effect on capacity requirements. Suppose we had started with peak loads per Column 4 (peak plus 1%) and had reduced them 1%; then the 1% *reduction* would have effected these same substantial capacity *savings* per Column 6.

Second, take a look at the accompany-

SLASH OPERATING COSTS...

with Tel-E-Lect POLE LINE EQUIPMENT

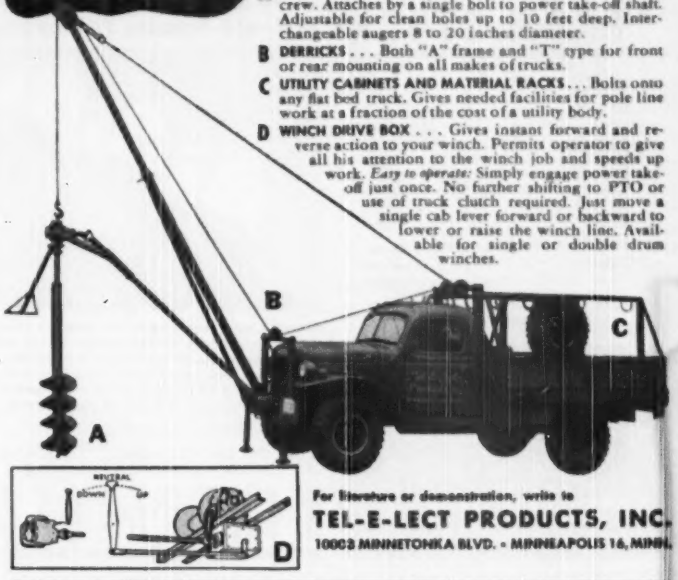
For installation on your present truck – or on new equipment

A **POLE HOLE DIGGER** . . . Uses your regular derrick and crew. Attaches by a single bolt to power take-off shaft. Adjustable for clean holes up to 10 feet deep. Interchangeable augers 8 to 20 inches diameter.

B **DERRICKS** . . . Both "A" frame and "T" type for front or rear mounting on all makes of trucks.

C **UTILITY CABINETS AND MATERIAL RACKS** . . . Bolts onto any flat bed truck. Gives needed facilities for pole line work at a fraction of the cost of a utility body.

D **WINCH DRIVE BOX** . . . Gives instant forward and reverse action to your winch. Permits operator to give all his attention to the winch job and speeds up work. *Easy to operate:* Simply engage power take-off just once. No further shifting to PTO or use of truck clutch required. Just move a single cab lever forward or backward to lower or raise the winch line. Available for single or double drum winches.



For literature or demonstration, write to
TEL-E-LECT PRODUCTS, INC.
10003 MINNETONKA BLVD. • MINNEAPOLIS 16, MINN.

Now! BEND THIN-WALL CONDUIT PROFITABLY

All This is Yours with Hydraulic Porta-Power

- Spectacular Speed
- Easy Operation
- Rigid, Professional Installations

At last—you can bend thin-wall conduit efficiently, profitably. You tight progress of bending from the most convenient spot because the hydraulic ram is *remotely-operated!* Make beautiful, kinkless bends, matched offsets and *rigid* installations in record time. Handle 1½; 1½ and 2" sizes. Dramatic savings in materials. Portable. Pays for itself on your first good job. Hydraulic unit also serves Rigid Pipe Bender. Buy from leading supply houses. Get full facts on hydraulic equipment for installing pipe and conduit by rushing coupon requesting Bulletin 50-B.

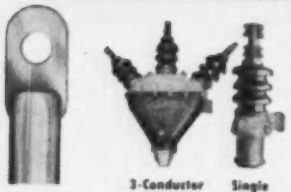
BLACKHAWK

BLACKHAWK MFG. CO.
Dept. P 4119
Milwaukee 1, Wis.

Without obligation, rush Bulletin 50-B.

Name.....
Firm.....
Address.....
City.....State.....

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
RMC
FROM STOCK



Soldering Lug | 3-Conductor Angle Pothead | Single Conductor Pothead

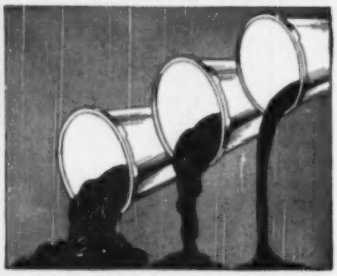
Write for a complete selection of RUSGREEN bulletins

INDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

Insulating and Cable-Pulling
COMPOUNDS
of Record-Breaking Performance



Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bills, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

for Results

McGRAW-HILL
DIRECT MAIL LIST SERVICE

If You Are Having Difficulty Maintaining Your Mailing Lists...

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled change in industrial personnel.

McGraw-Hill Mailing Lists cover most major industries. They are compiled from exclusive sources, and are based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff. All names are guaranteed accurate within 2%.

When planning your direct mail advertising and sales promotion, consider this unique and economical service in relation to your product. Details on request.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street New York, 18, New York

ELECTRITE
A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE
An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department
WEST VIRGINIA PULP & PAPER COMPANY
230 Park Ave. New York 17, N. Y. 111 W. Monroe St. Chicago 3, Ill.

Effect of 1% Load Increase on Generating Capacity Requirements

Peaks (Column 1) are identical with those of Table 2 ("The Cost of Supplying Electrical Losses"), except in years 1907, '09, '14, and '30, when they are 1 mw less, respectively. Machine sizes (Column 2) and capacity requirements (Column 3) as in Table 2. Column 5 shows generating capacity required after an increase of 1% in annual peaks (Column 4). In this case, increased generating capacity requirements (Column 6) are nil.

Col.	1	2	3	4	5	6
Year	Peak Load (mw)	Unit Size (mw)	Capacity Required (mw)	Peak Plus 1% (mw)	Capacity Required After 1% Increase (mw)	Increased Capacity (mw)
1905	37	10	40	37	40	0
06	43	10	50	43	50	0
07	49	10	50	50	50	0
08	53	10	60	54	60	0
09	59	10	60	60	60	0
10	68	10	70	69	70	0
11	79	10	80	80	80	0
12	94	10	100	95	100	0
13	108	10	110	109	110	0
14	119	10	120	120	120	0
15	140	25	145	141	145	0
16	166	25	170	168	170	0
17	180	25	195	182	195	0
18	185	25	195	187	195	0
19	208	25	220	210	220	0
20	216	25	220	218	220	0
21	214	25	220	216	220	0
22	250	25	270	253	270	0
23	283	25	295	286	295	0
24	336	25	345	339	345	0
25	357	50	395	371	395	0
26	415	50	445	419	445	0
27	436	50	445	440	445	0
28	481	50	495	486	495	0
29	537	50	545	542	545	0
30	540	50	545	545	545	0
31	496	50	545	501	545	0
32	467	50	545	472	545	0
33	489	50	545	494	545	0
34	496	50	545	501	545	0
35	535	75	545	540	545	0
36	588	75	620	594	620	0
37	585	75	620	591	620	0
38	632	75	695	638	695	0
39	718	75	770	725	770	0
40	780	75	845	788	845	0
41	871	75	920	880	920	0
42	843	75	920	851	920	0
43	902	75	920	911	920	0
44	1017	75	1070	1027	1070	0

ing table. It duplicates Table 3 in every respect except that the peak loads (Column 1) differ by 1 mw in only 4 of the 44 years—in 1907, '09, '14, and '30. This minor change, resulting from pure chance, would reduce the "substantial" savings of Table 3 to zero.

Third, consider Table 2. Suppose the peak loads before the 1% reduction happened to be the figures of Column 4, Table 2, by pure chance. You would then find that some capacity savings would be realized, just because the peaks happened to be slightly different.

No, I can't agree to the "never" or the "certain". But in any event, I do appreciate your continuing interest in this subject and in the particular presentation of it, as evinced by other recent observations in your column.

Paul H. Jeynes
Public Service Electric & Gas Co
Newark, N. J.

WORST in 17 years

All-Aluminum Stands Test

To the Editor of ELECTRICAL WORLD:

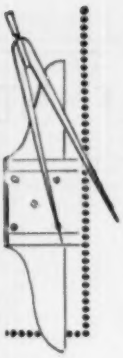
In ELECTRICAL WORLD of February 28, 1948, you published an article by me on the use of all-aluminum conductors for distribution circuits. We have been wondering what effect ice loading would have upon this wire as have a number of skeptics who are afraid to change over to it and thus save a lot of money on conductor costs.

Now we know! The lines were designed for ¼-in. of ice, but last week (January 6) we had ½ in. in most places and in some places even more. All-aluminum came through with a perfect record—no breaks or burn downs due directly to ice load; no burn downs due to conductors slapping together as the ice melted; two breaks where trees broke and fell across the lines; one break where a pole broke off and fell. The 300 foot spans of No. 2 all-aluminum sagged down perhaps 10 or 12 feet extra while the ice was on; but when the ice melted, it came back up to proper final sag.

. . . We wish we had all-aluminum conductors up where we now have a lot of very old soft-drawn and medium hard drawn weatherproof copper.

Charles E. Bryan
Chief Engineer
Jackson Electric Department
Jackson, Tennessee

(Editor's Note: To give readers an idea of what the January 6 ice storm was like that tested Mr. Bryan's all-aluminum line we republish (above) a picture from ELECTRICAL WORLD of January 16, 1950, showing how things looked in nearby Memphis about 80 airline miles away.)



Designed to meet your needs...

TRAILERS

IN A WIDE RANGE OF SIZES AND TYPES

Combination Cable Reel and Pole Trailer — PCP & W-PCP Series: Quickly converted from cable reel to pole trailer — dual use provides low initial cost — only one trailer license needed.

PBT Series All Purpose Trailer: Combination cargo and pole trailer — new in design — versatile — many practical advantages. Front and rear bolsters, extension tongue, removable fenders and side boards, roomy cargo space.

1485-A Pole Trailer: Tubular-type tongue construction for strength with light weight. Rear bunk balances trailer and provides easy handling when empty.

M Series Pole Trailer: 3 to 5 tons, exceptionally rugged. Heavy duty bearings permit dual tires. Extension tongue. Maximum safety, dependability, flexibility.

These trailers are representative of the wide line offered by FWD-Eagle — equipment engineered by and for utility men expressly for their needs.

FWD

Designed by CITIZEN

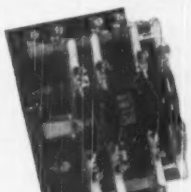
EAGLE MANUFACTURING CO.

Division of the Four Wheel Drive Auto Co.

APPLETON WISCONSIN

Write today for the complete catalog of FWD Line Construction and Maintenance Equipment — a useful reference book.

Multi-Contact RELAYS for Specialized Controls



featuring Mechanical locking, no latching.

Single solenoid action with integral control contacts permitting circuit connections equivalent to a two-coil unit.

Wiping and adjustable contacts for reliable service at milliamperes of load at low voltage or at full rating.

rated at 10 and 25 amperes; AC to 550 volts; DC to 250 volts.

in three available combinations

10 amperes to 12 poles normally open and 12 poles normally closed or any combination of normally open and normally closed poles. 550 volt AC maximum.

10 amperes to 6 poles normally open and 6 poles normally closed or any combination of normally open and normally closed poles. 250 volt DC maximum.

25 amperes to 6 poles normally open and 6 poles normally closed or any combination of normally open and normally closed poles. 250 volt DC 550 volt AC maximum.

Do you require a sturdy reliable RELAY to maintain circuit control regardless of momentary interruption in control line due either to low voltage or associated relay operating time? Do you need a RELAY to provide "memory" circuits or to permit preset control operations? Utilities have found them very useful in combination for AC service on contacts, DC operating coil. Control systems needed for many machine tools, industrial machines and furnaces will find such a RELAY in this special ASCO design. And when the AC hum of a magnetically-held relay would be a nuisance, this mechanically held ASCO RELAY would be ideal.

In writing for further information, write us fully about your requirements.

AUTOMATIC TRANSFER SWITCHES • REMOTE CONTROL SWITCHES • CONTACTORS • RELAYS

We also manufacture a complete line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases

ASCO Electro-Magnetic CONTROLS

Automatic Switch Co.

397 Lakeside Avenue • Orange, New Jersey

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
34 State Street, Albany, N. Y.

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway — Kansas City 2, Missouri

HUGH L. COOPER & CO., INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro - electric power plants.

350 Fifth Avenue — New York 1, N. Y.

ROBERT A. CUMMINGS, JR. AND ASSOCIATES

Aerial Mapping Surveys

Aerial Photography, Mosaics, Strip Maps
Topographic Maps, Profiles,
Structural & Mechanical Design

239 4th Ave. — Pittsburgh 22, Pa.

DAY & ZIMMERMANN, INC.

Engineers

Design - Construction - Management
Investigations and Reports

PHILADELPHIA
NEW YORK — Packard Building — CHICAGO

Doble Engineering Company

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr. — Chicago, Ill.

Ebasco Services Incorporated

Engineers - Constructors - Business Consultants

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street — New York

ELECTRICAL TESTING LABORATORIES INC.

Specializing in
TECHNICAL SERVICES
to those intent upon good quality

8 East End Avenue at 79th St., New York 21, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Design—Surveys—Appraisals
Construction & Maintenance
Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. — Binghamton, N. Y.

The Real Value

of placing your unusual problem in the hands of a competent consultant is that it eliminates the elements of chance and uncertainty from the problem and provides real facts upon which to base decisions.

FORD, BACON & DAVIS

Engineers

DESIGN . CONSTRUCTION
VALUATIONS . REPORTS

New York . Philadelphia . Chicago . Los Angeles

GILBERT ASSOCIATES, Inc.

Engineers and Consultants

DESIGN AND SUPERVISION OF STEAM, HYDRO, WATER SUPPLY, SEWAGE DISPOSAL AND DIESEL PLANTS
Reports . Rates . Labor Relations . Safety
Purchasing . Costs . Laboratory

New York — Reading, Pa. — Washington
Houston — Philadelphia

HARZA ENGINEERING CO.

Consulting Engineers

L. F. HARZA
E. MONTFORD FUCIK CALVIN V. DAVIS
Hydro-Electric Power Projects
Transmission Lines, System Management,
Dams, Foundations, Harbor Structures,
Soil Mechanics

400 W. Madison St. — Chicago 6, Ill.

HOOSIER ENGINEERING COMPANY

Erecting Engineers

Transmission Lines, Substations

66 So. 5th St., Columbus, Ohio
227 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

N. A. LOUGEE & COMPANY

(Successors to J. H. Manning & Company)

REPORTS—INVESTIGATIONS—VALUATIONS
BUSINESS AND ECONOMIC STUDIES

120 Broadway — New York

LUCAS & LUICK

Engineers

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

ARTHUR L. MULLERGREN

Engineering-Management

Public—Utilities—Natural Gas

Kansas City, Mo.

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing . .
Specialists in Financing
Accounting and Other Operations

231 So. La Salle St. — Chicago 4

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD

Bill Frequency Analyzer

100 Sixth Ave. WOrth 4-8326 New York 13, N. Y.

SANDERSON & PORTER

Engineers and Constructors

New York — Chicago
San Francisco — Los Angeles

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

F. W. SCHEIDENHELM

Consulting Engineer

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

50 Church Street. — New York 7, N. Y.

F. A. TUCKER, INC.

Contractors—Engineers

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges - Dams

Main Office—38½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N. C.

UTILITIES LINE CONSTRUCTION COMPANY, INC.

Construction and Maintenance

Transmission-Distribution
Electric and Telephone Lines
Consultants

501 York Road — 1240 Oliver Bldg.
Jenkintown, Pa. — Pittsburgh, Pa.

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

SEARCHLIGHT SECTION

Classified Advertising

EMPLOYMENT — BUSINESS
EQUIPMENT — USED OR RESALE

OPPORTUNITIES

UNDISPLAYED RATE

(Not available for equipment advertising)

$1.20 a line, minimum 4 lines.
To figure advance payment count 5 average words as a line.

Individual Employment Wanted—Advertising rate is ½ the above rate payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

ENGINEERS

Required for Research and Development of Aluminum Application In the Electrical Industry

Applicants must have good academic qualifications in physics, electrical engineering and/or non-ferrous metallurgy. Positions are open for a senior engineer, with not less than 5 years industrial experience, and 2 or 3 juniors. Applications must state education, age, experience and approximate salary requirements. Reply at

KAISER ALUMINUM AND CHEMICAL CORPORATION
Newark, Ohio

ELECTRICAL DESIGNERS

ESTABLISHED BOSTON CONSULTANTS HAVE OPENINGS FOR ELECTRICAL ENGINEERS AND DESIGNERS WITH POWER PLANT AND INDUSTRIAL DESIGN EXPERIENCE.

P-1618, Electrical World
330 W. 42nd St., New York 18, N. Y.

WANTED

POWER SALES ENGINEER

for sales development work with industry and the farm. Engineering graduate, age 30 - 35, sales experience desirable. Good opportunity with small progressive electric utility in Ohio. Write, giving full information and salary expected.

SW-1943, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

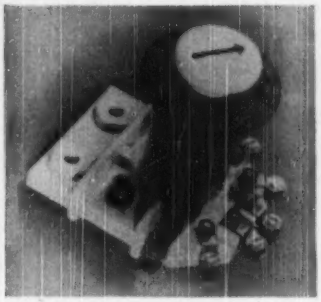
REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

DEVELOPMENT AND Application Engineer. Experienced in designing building, and field application of specialized electrical and mechanical instruments and test equipment. Opportunity to introduce, develop and apply new test equipment in utilities, industrials and railroads. Well-established, medium-size company. Location east. P-1917, Electrical World.

(Continued on page 204)

CUSTOM & STANDARD BUILT SWITCHES - TEST TABLES FOR TESTING ALL TYPE METERS



Porcelain base switch approved for use on 15-KV transformer 60 amp. current capacity. Positive snap action on positioning of roller, has that "feel." Pressure on all positions gives greater efficiency in oil.

(PATENT PENDING)

Letters or numbers, top or bottom, as required for position marking.

We dock switches up to 700 amp. load in oil, used on voltages up to 50,000.

Brass studs standard 12 ft. length or cut to length required. ¼" 5/16", ⅜", ½", ¾", 1" stud sizes.

THE NOTNAC MFG. CO.

1410 Second St., S. W. Canton 2, Ohio

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power.

In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street, New York, 18, N. Y.

ELECTRICAL MACHINERY

1. New 3rd Edition. Packed with up-to-date help explaining the installation, operation and maintenance of electrical machinery . . . from the fundamentals of magnetism, electro-magnets and electrical circuits . . . to the latest available data on electron tubes and circuits in which they are used. Includes material on how electrical instruments are built, meters and measurement techniques, a-c and d-c motors, etc. **By F. A. Annett, Power. 438 pages, $5.75**

HANDBOOK OF RIGGING

2. Condensed into this one book are tips, methods and techniques essential to more effective rigging practices in industrial and construction operations. Deals with everyday maintenance operations — with the transportation and handling of heavy machinery — and with the erection and demolition of smaller size structures. Covers everything from ropes, hoisting chains and hooks, to slings, ladders and hoist signals. **By W. E. Rossnagel, Safety Eng'r. 331 pages, $4.75**

POWER CAPACITORS

3. A wealth of data on the design, manufacture and efficient use of power capacitors. Covers fundamental working principles, the materials used in their manufacture, and the characteristics of the completed capacitor units. Operating limitations and respective fields of application are discussed, as is the use of accessories such as fuses, circuit breakers, etc. with power capacitors. Provides a clear picture of high frequency capacitors for frequencies up to 12,000 cycles. **By R. E. Marbury, Westinghouse Electric Corp. 204 pages, $3.50**

TRANSFORMER PRINCIPLES AND PRACTICE

4. In this new 2nd edition, you'll find a nonmathematical description of some types of transformers and the principles underlying their application. Presents modern data on current limiting reactors, and new illustrations showing up-to-date construction practices. Gives a detailed discussion of single and three-phase transformers, coils and cores, maintaining oil quality, transformer polarity, special applications of standard transformers, and NEMA instructions in the care and operation of transformers. **By J. B. Gibbs, Electrical Eng'r. 265 pages, $3.50**

SEE THESE BOOKS 10 DAYS FREE

McGRAW-HILL

McGraw-Hill Book Co., Inc.,
330 W. 42nd St.,
New York 18

Send me book(s) corresponding to numbers encircled below for 10 days' examination or approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

1 2 3 4

Name .....
Address .....
City ..... Zone .... State .....
Company .....
Position W-1-30-50

This offer applies to U. S. only.

DESIGN ENGINEER VACANCIES

Progressive and Growing Midwest Electrical Manufacturing Organization, One of the Leaders in Outdoor Electric Power Distribution and Transmission Equipment, Has Openings for:

(1) Designers for High Voltage Air Break Switches and Related Equipment.

(2) Electrical and Mechanical Engineers for Development and Design of Distribution Protective Equipment.

(3) Designers Experienced in Stampings, Screw Machine Parts, and Other Mass Production Items Where Cost Is a Vital Consideration.

All Positions Are Permanent. Only Experienced Men Will Be Considered.

P-2040, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

DIESEL POWER

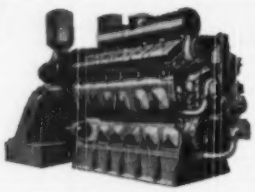
FOR

IMMEDIATE SHIPMENT

UNIT CAPACITIES—10 TO 1875 KVA

A.C.—50 AND 60 CYCLES

VARIOUS VOLTAGES



A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	38F16	2600	300	375	Enterprise	DSG-6	450	450
1420	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KSA	396	514
1250	General Motors	16-278A	1600	720	312	General Motors	9-268A	450	1200
937.5	General Motors	12-567	1080	720	312	Clark	MD-4	375	327
625	Alco	6-12½x13T	750	600	187	Ingersoll Rand	S	225	514
425	Baldwin	VO-6	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	75	General Motors	6043C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.

DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

GUARANTEED "REBUILTS" at . . . CHICAGO ELECTRIC

1000 K.W., Gen. Elec., Type MPC, shunt 275 volt, 3640 amp., direct connected to 1120 K.V.A. Gen. Elec. type TS, 3 ph. 60 cy. 4600 volt, 141 amp. 8 PF. 514 RPM, on fab. sub-base (2300 volt fields less exciter).

D.C. GENERATORS

K.W.	Make	Volts	Speed
125	G.E.-R.C.	125	720
100	Al. Ch.-E.	250	775
75	Westg.-SK.	250	720
65	G.E.-E.	125	1100

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle — 220 or 440 Volt (2200 Volt or Higher)

HP	Make	Type	Speed
750	*G.E.	SY	720
700	*G.E.	KP-5694T	1800
600	*Westg.	CR-6-34-15	1200
500	*G.E.	K-5591DE	3600
500	*G.E.	IK	1900
500	G.E.	KTP-567	1200
500	G.E.	IK	900
400	*G.E.	IK	1800
400	*Westg.	CR-506	1800
400	Al. Ch.	ANW	900
400	*Westg. Vert.	CR	720
400	G.E.	IK	600
350	*Westg.	CR	900
350	G.E.	IK	600

ALSO STOCK "REBUILTS" IN:

- AC MOTORS
- DC MOTORS
- GENERATORS
- M.G. SETS
- TRANSFORMERS
- COMPRESSORS
- CONTROLS
- SWITCHBOARDS
- HOISTS & CRANES

Write Today

CHICAGO ELECTRIC CO.

1324 W. CERMAK RD. CHICAGO 8, ILLINOIS

FOR SALE

4—1677 KVA Standard transformers, subtractive polarity 13200 to 2400 volts, 2-2½% taps above and below. Two years in service.

4—1000 KVA Standard transformers, subtractive polarity 13200 to 2400 volts, 2-2½% taps above and below. Two years in service.

3—500 KVA Rebuilt Pittsburgh transformers, subtractive polarity 13,800 to 2300 volts, 4-2½% taps below. Fifteen years in service.

2—1000 KVA General Electric transformers, subtractive polarity, 13,800 to 2300 volts, 5-2% taps below. Fifteen years in service.

1—Westinghouse three phase regulator—13,800 volts, 10% plus or minus. Two years in service.

CULLMAN POWER BOARD

CULLMAN, ALABAMA

POSITIONS VACANT

WANTED, SEVERAL engineering graduates, under 35, by large industrial fire prevention organization maintained by national insurance group, for field work involving periodic inspections and special consulting service. Permanent. P-1995, Electrical World.

WANTED, SALES Engineer. Requirements (1) Electrical Engineering Degree; (2) First hand knowledge of electric line construction materials; (3) Experience with, or preferably employment within, electric public utilities; (4) A sales-minded, hard-driving extrovert; (5) Willingness to travel. Permanent position as direct-from-factory contact man, on nation-wide basis, between a midwest manufacturer of line construction materials and its customers, electrical public utilities. Write P-2078, Electrical World.

SELLING OPPORTUNITY OFFERED

WANTED ELECTRICAL Engineer to travel and assist in sales of transformers and distribution equipment. Preferably with some utility experience. State briefly qualifications, experience and age in reply to: SW 2022, Electrical World.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

POSITION WANTED

WANTED: POSITION as meter tester or meter repair. Several years experience in testing. PW-1778, Electrical World.

ELECTRICAL ENGINEER, reg., 33, eleven years power system operation, control and protection, calculating board exper., desires employment with private utility. PW-1898, Electrical World.

CONSTRUCTION SUPERINTENDENT Substations, Transmission and Distribution Lines and underground systems. Good estimating and organizing ability. Employed, prefer change domestic or foreign. References and interview. PW-1915, Electrical World.

GRADUATE ELECTRICAL Engineer, 38, married, 15 years hydropower, utility, industrial engineering, planning, administration in America and Europe desires responsible position with utility, large mining or industrial enterprise in Northwest, Canada or Alaska. Replies: PW-1941, Electrical World.

ENGINEER, 51, BS, EE, 20 yrs. exp. public utilities and industrial, can take charge small plant electrical division, send for resume, N. J. registered. PW-1289, Electrical World.

POSITION AS Electrical Sales engineering trainee (power equipment) wanted by young electrical design-draftsman with degree and 3½ yrs. experience in the industrial, power plant, and refinery fields. PW-1975, Electrical World.

SELLING OPPORTUNITY OFFERED

SALESMAN OR Engineer now visiting utilities to handle reconditioned watthour meters, parts, etc. Commission basis. SW-1933, Electrical World.

SWITCH, BX, EMT, and Thermostat Cable Lines wanted by well established manufacturers' representative for Illinois, Indiana, Michigan, Wisconsin, Minnesota, Dakotas and Montana. RA-1936, Electrical World.

Electrical Meter Engineering
"The Profession With a Future"

Meter Department demands are bringing good opportunities to meter experts.
HOME STUDY COURSE
Practical up-to-date home study covers all phases of Meter Work
Write Today for Free Booklet
Fort Wayne Correspondence School
Dept. 115, 201 Dime Bk. Bldg. Fort Wayne 2, Ind.

FOR SALE

EARTH BORING MACHINES

New and Used with Equipment As Listed

USED

5—Earth Boring Machines, Highway Model HD, mounted and ready for work.
5—2½ Ton 6x6 Trucks
5—Highway Double Drum Winches with two way Power Take Off installed
5—Truck Bodies fully designed for Line Construction work.
5—Booms, T Type or Tri-Pod.

Price for Each Unit . . $5,750

SLIGHTLY USED

1—Model H Jaques Demonstrator mounted on All-Wheel-Drive truck. Pole Setter, Extra Augers and Equipped, ready for work.

A Tremendous Savings at . . $7,800

NEW

4—Model K Jaques Machines. Priced to sell quick. These machines are available as result of building own machines, the NEW "STERLING" Model "A". Ask for a demonstration! Check with our owners as to responsibility and type service we offer!

WYOMING VALLEY EQUIPMENT COMPANY

1089 Wyoming Avenue
Forty Fort (Wilkes-Barre) Penna.

TRANSFORMERS
(3) FOR SALE

G. E. 500 KVA, Type HS, Form WD O.I.S.C. outdoor type transformers 60 Cy., Single Ph., Pri. V. 12,000 Sec. V. 240/480, 4.85% impedance Ser. No. 6,910,195, 7 and 8. Located at Syracuse New York.

Write Box E.W. 1006, Equity
221 W 41 St., N. Y. 18, N.Y.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.

52 Church St., New York 7, N. Y.

FOR SALE

1 675 HP. Worthington Air Injection Diesel Engine.
1 440 HP. Busch-Sulzer Air Injection Diesel Engine.
Including all auxiliaries, motor, generators, etc.
Can be seen in operation any time.
Contact Mayor or City Clerk
Independence, Iowa

NEW and REBUILT
MOTORS
GENERATORS
TRANSFORMERS
1 to 1500 H. P.
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, NEW YORK

FROM AVAILABLE STOCK

TURBO GENERATORS

KW	Make	Desc.
4000	G.E.	Auto extraction—850 lbs. I.S.P. 35 lbs. ext.—2300 V. 3 ph. 60 cy.
750	G.E.	Condensing—350 lbs. I.S.P. 440 v. 3 ph. 60 cy.—Built 1944
300	G.E.	Non-condensing 150/175 I.S.P. 5/10 D.P.—480 v. 3 ph. 60 cy.
600	Wlms.	Non-condensing 125/150 lbs. I.S.P. 5/10 lbs. D.P.—240/480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
5140	Wlms.		2400/4160	600
4000	G.E.	TSC	2400/4160	900
3000	Wlms.		2400/4800	720

MOTOR GENERATOR SETS
3 ph. 60 cy.

KW	Make	Speed	DC Volts	AC Volts
1500	G.E.	600	125/250	2300/4160
1500	G.E.	600	115	2300/4160
1250	G.E.	600	115	4160
1250	G.E.	600	115	4160
1000	Wlms.	600	600	4160

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph	Voltages
2500	Wlms.	OISC	3	6600Δ/3810Y
2500	Al. Ch.	OISC	3	12000Δ/6930Y
2500	Pack.	AY	3	12000Δ/6930Y
1500	G.E.	HVDDJ	3	2400/4160Y
1500	Pitts.	OISC	3	12000Δ/6930Y
1000	Al. Ch.	OISC	3	2300/4160Δ/2400/4160Y
1000	Pitts.	OISC	3	12000Δ/6930Y
167	G.E.	HS	1	2400x4160—480

FREQUENCY CHANGERS

2500	KW	G.E.	25/60 cy. 2300/3300 v.
200	KW	A. C.	25/60cy. 1100/2300v.

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS
1000 KW TO 100 KW
STATIONARY AND PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Telephone NEvada 6-2808
Cable Address HEMCOY

1412 So. Alameda Street
Compton 1, Calif.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

SLIP RING MOTORS

1—2500 HP G.E. MT 257 RPM 6900V
1— 500 HP G.E. MT 720 RPM 2200 V 4150

SYNCHRONOUS CONDENSER

1—2500 KVA Whse 720 RPM 2200 V with D.C. Exc.

MOTOR GENERATORS

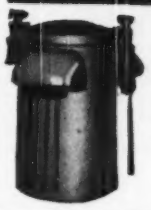
1—1000 KW Whse 275 V 720 RPM 4150 Volt
1—1000 KW G.E. 600 V 514 RPM 2200/6000 V
1— 500 KW G.E. 275 V 900 RPM 4150 Volt
2— 150 KW G.E. 125/250 V 1200 RPM 4150 Volt

TRANSFORMERS

1—1500 KVA G.E. 3 Ph. 4150 V 480 V Pyranol
1—1000 KVA G.E. 3 Ph. 4150 V 2400 V
1—1000 G.E. 3 Ph. 4150, 2 Ph. 2400 V
2— 750 KVA G.E. 3 Ph. 4150 V 480 V Pyranol
3— 400 KVA G.E. 6900 2300 V Sec.
3— 100 KVA G.E. 4150-240/480 V Pyranol
3— 75 KVA G.E. 2400-240/480 V
3— 75 KVA Whse 2500 240/115
3— 50 KVA Whse 2400-240/120
5— 50 KVA Whse 4150-120/240 Isertson

Complete Line of A.C. and D.C. Motors and Generators

-TRANSFORMERS-



BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes. One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 37, OHIO

Advertising In This Issue

Accurate Mfg Co. ... 178
Air Preheater Corp., The ... 54
Albion Malleable Iron Co ... 191
Allis-Chalmers Mfg. Co. ... 4, 84, 85
American Brass Co., The ... 75
American Bridge Co ... 71
American Coach & Body Co., The 77
American Steel & Wire Co. ... 40, 41
American Structural Products Co. 197
American Transformer Co ... 177
Anaconda Wire & Cable Co ... 28
Ansul Chemical Co ... 174
Appleton Electric Co ... 53
"Automatic" Sprinkler Corp. of America ... 170
Automatic Switch Co ... 201

Bailey Meter Co ... 60, 61
Bartlett Tree Experts ... 193
Baxter & Co., J. H ... 152
Bendix Aviation Corp., Friez Instrument Div ... 78
Biddle Co., James G ... 39
Binkley Mfg. Co ... 198
Blackburn Products Corp., Jasper 29
Blackhawk Mfg. Co ... 199
Brown-Boveri Corp. ... 73
Brown Co. ... 151
Brown Instrument Div., Minneapolis-Honeywell Regulator Co. ... 182

Chase-Shawmut Co., The ... 83
Chevrolet Motor Div., General Motors Corp. ... 64
Coal Chemical Sales, Div. U. S. Steel ... 76
Cobra Wood Treatment Corp. ... 176
Cochrane Corp. ... 69
Consolidated Treating Co ... 74
Copperweld Steel Co. ... 12, 13
Cornell-Dubilier Electric Corp. ... 63
Corning Glass Works ... 47
C-O-Two Fire Equipment Co. ... 155
Crescent Tool Co ... 49
Crouse-Hinds Co. ... 20, 21

Day-Brite Lighting, Inc. ... 187
De Laval Separator Co., The ... 52
Directory of Engineers ... 202
Dodge Div. of Chrysler Corp. ... 56
Dow Chemical Co ... 171
Driver-Harris Co. ... 163
du Pont de Nemours & Co., (Inc.), Rubber Chemicals Dept. ... 46

Eagle Mfg. Co. ... 201
Ebasco Services, Inc ... 189
Eilar Tree Experts ... 196
Electrical Testing Laboratories, Inc. ... 35
Electroline Company ... 5
Elliott Co. ... 32, 33
Engineers, Directory of ... 202

Fargo Mfg. Co., Inc ... 173
Ferranti Electric, Inc ... 168
Fisher-Pierce Co., Inc., The ... 186
Foster Wheeler Corp. ... 44, 45

G&W Electric Specialty Co ... 68
General Electric Co.
Apparatus Dept. ... 132, 133, 135, 136, 137, 143
Chemical Dept. ... 38
Lamp Dept. ... 156, 157
Grinnell Co., Inc ... 82
Guth Co., The Edwin F. ... 160, 161

Haley & Co., Inc., R. G. ... 198
Hazard Insulated Wire Works 18, 19
Hi-Voltage Equipment Co. ... 179
Holophane Company, Inc ... 51
Hubbard & Co. ... 165
Hughes Bros. ... 15

Indiana Steel & Wire Co. ... 172
Ingersoll-Rand ... 70
I-T-E Circuit Breaker Co. ... 180, 181

Johns-Manville ... 55, 184, 198

Kearney Corp., James R. ... 79, 80, 81
Kellogg Co., Inc., M. W ... 65
Kerite Co., The ... 86
Knox Porcelain Corp ... 31
Koppers Co., Inc ... 195
Kuhlman Electric Co. ... Fourth Cover

Lapp Insulator Co., Inc ... 24
Leader Electric Co ... 22

Macallen Co., The ... 67
Mallory & Co., Inc., P. R. ... 42
McGraw-Hill Book Co. ... 203
Mica Insulator Co. ... 7
Miller Co., The ... 59
Minerallac Electric Co. ... 200
Moloney Electric Co. ... 140, 141
Murray Mfg. Corp. ... 25

Notnac Mfg. Co., The ... 203

Ohio Brass Co. ... 147, 148, 149, 150
Okonite Co., The ... 18, 19
Orangeburg Mfg. Co., Inc. ... 62

Pacific Electric Mfg. Corp. ... 27
Palnut Co., The ... 197
Pennsylvania Transformer Co. 166, 167
Penn-Union Electric Corp. ... 169
Philadelphia Gear Works, Inc. ... 66
Pioneer Service & Engineering Co. 192
Porcelain Insulator Corp. ... 188
Porcelain Products, Inc. ... 23
Preformed Line Products Co. ... 26

Railway & Industrial Engineering Co. ... 57
Revere Copper & Brass, Inc. ... 139
Riley Stoker Corp. ... 16, 17
Roebling's Sons Co., John A. ... 145
Roller-Smith ... 153
Rome Cable Corp. ... 30
Royal Electric Mfg. Co. ... 50
Rusgreen Mfg. Co. ... 200

S&C Electric Co. ... 8, 9
Sangamo Electric Co. ... 6
Searchlight Section ... 203, 204, 205
Silent Hoist & Crane Co. ... 194
Simplex Wire & Cable Co. ... 43
Smith Co., S. Morgan ... 34
Sorg Printing Co., Inc, The ... 185
Southern Electrical Corp. ... 175
Standard Transformer Co. ... 36, 37
Superior Engine Div., National Supply Co. ... 48
Superior Switchboard & Devices Co. ... 196

Tel-E-Lect Products, Inc. ... 199
Thomas & Sons Co., R. ... 14
Triangle Conduit & Cable Co., Inc. 10

United States Steel Corp. ... 40, 41, 58, 71, 76
United States Steel Supply Co. ... 58

Victor Insulators, Inc ... 154

Wagner Electric Corp. ... 11
West Virginia Pulp & Paper Co. ... 200
Westinghouse Electric Corp. ... Third Cover, 159
Westinghouse Electric Corp Lamp Dept. ... 72
Weston Electrical Instrument Corp. ... Second Cover
Wiley & Sons, Inc., John ... 194

■

PROFESSIONAL SERVICES ... 202

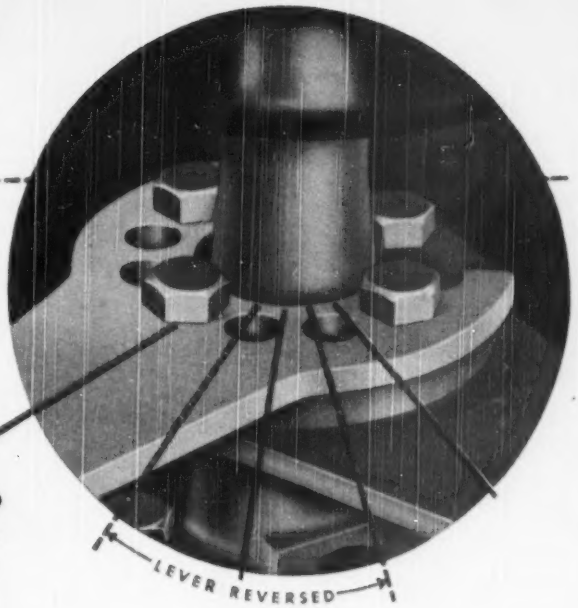
■

SEARCHLIGHT SECTION
(Classified Advertising)

EMPLOYMENT
Positions Vacant ... 203, 204
Selling Opportunities Offered ... 203, 204
Positions Wanted ... 204
Selling Opportunities Wanted ... 204
Employment Services ... 204
EDUCATIONAL
Schools ... 204
EQUIPMENT
(Used or Surplus New)
For Sale ... 204, 205

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Asymmetric drilling of 30° mounting holes in the new Universal Mounting Lever enables it to be set at 15° intervals—within 7½° of the desired angle.

15° ANGLES make switch mechanisms universal

Now you can order your disconnecting switches complete with operating mechanisms at the time your structure is planned. No need to wait for final details to be worked out. Just order Westinghouse Type V Switches with the Universal Mechanism—and you can be sure they'll meet any but the most unusual arrangements. That's because the new operating lever can be set within 7½° of any desired angle to provide easy operation.

Here is another place where attention to little things makes the Westinghouse Type V Disconnecting Switch the biggest dollar value on the market today. Get the benefits of experience and top-grade switch design in your system. Install the Westinghouse Type V.

For complete information on the Type V, or on the entire Westinghouse switch family, get in touch with your nearby Westinghouse office or distributor. Ask for B-4241 and B-4242. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

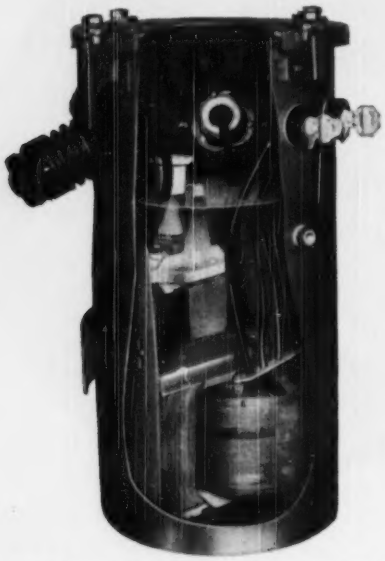
J-60701

Westinghouse

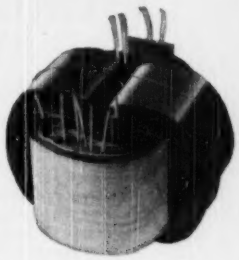
TYPE V

DISCONNECTING SWITCHES

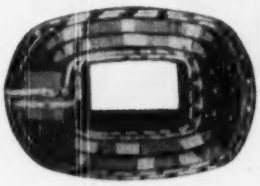
How KUHLMAN builds for lasting service



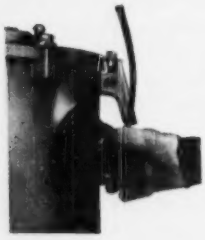
The cutaway above gives graphic proof of the sound, carefully engineered construction of Kuhlman Distribution Transformers. These transformers have been proved "under fire" for over half a century, yet we take nothing for granted — Kuhlman is continually in search of new materials, new methods, new designs, which will mean even greater efficiency, safety and economy for you. A few of the many outstanding features of the Kuhlman Distribution Transformer are pictured and described below.



The heart of every Kuhlman Transformer 25 KVA and below, is the famous Kuhlman Bent Iron Core made of cold rolled, oriented silicon steel. It permits the flux path to follow the grain of the steel, resulting in higher permeability, lower hysteresis and saving 25% in weight over cores using hot rolled steel. Core and copper losses are reduced, and exciting current is reduced as much as 75% by utilizing lapped joint construction. In short, the Kuhlman Bent Iron Core is more efficient, smaller, lighter, easier to handle — and *only* Kuhlman has it!



Wide oil ducts. Ample oil circulation is assured by wide oil ducts throughout the windings. The oil itself has been refined to a degree which assures full stability. Transformers are filled with oil under vacuum so that no air is trapped inside. Completely protected coils are dried and coated with high grade phenolic base polymerizing type varnish which bonds the coil into a compact structure.



"Quick-grip" pocket bushings. Pocket type high voltage bushings can be connected as easily as your garden hose. All metallic parts are entirely surrounded by porcelain and by turning the knob at the end, the clamping mechanism opens or closes like a valve, freeing or securing the line connection. No tools necessary!

Write for this new bulletin CS-201 which gives complete facts including specifications on Kuhlman Distribution Transformers, Conventional Type 100 KVA and below. Kuhlman also manufactures a complete line of Power, Dry Type, Street Lighting, and Specialty Transformers. Bulletins available on request.

Sturdy, long-life tanks. All Kuhlman Distribution transformers have sealed tanks fabricated of heavy gauge copper bearing steel and are thoroughly tested for leaks after fabrication. Three coats of paint are put on over a shot blasted surface; one coat of rust inhibitive primer, and two coats of corrosion resistant paint. Tank surfaces have withstood 500 hours of salt spray and weatherometer tests.

EXPERIENCE COUNTS — THIS IS OUR 56TH YEAR

Kuhlman

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN

Export Representatives: *International Standard Electric Corporation,* **67 Broad St., New York City, N.Y. Cable Address: Microphone, N.Y.**